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OUR FRONT COVER

WISHING YOU A HAPPY AND PROSPEROUS NEW YEAR!

Little Cindy Bertram of Boise, Idaho, steps into the role of Miss Farmerette for 1951 and extends a willing hand to help many new homesteaders to clear their newly acquired lands of sagebrush. The tool which she proposes to use is somewhat obsolete where modern-day farming is concerned, but the apparent eagerness with which she approaches the huge task overshadows the inadequacy of the scythe. Photo by Stan Rasmussen, Region 1 Photographer.

30 YEARS AGO IN THE ERA

RECLAMATION IN IDAHO

Mr. R. E. Shepherd of the Western States Reclama Association, writing in the New West Magazine, speak the following happy vein concerning the Reclama Service:

"To my mind the United States Reclamation Servic better fitted to undertake the work of water conserva than the State or private enterprise, and any plan which not include this valuable department of the Governm would be quite unwise. The work of the United St Reclamation Service has resulted in the development large areas of desert and semiarid land in a most satis tory manner. The construction work of the Reclama Service is certainly a model of excellence. Its resea work and study in the problems of land reclamation h been of great value to all engaged in western developm It has already successfully built many large dams in v ous parts of the West. I know of none that have no practice come up to the expectations of those depend upon them."

(From page 31, January 1921 issue of the RECLAMAT RECORD, predecessor of the RECLAMATION ERA.)

RECLAMATION PLACE NAMES IN THIS ISSUE

REPORT ON THE 19th ANNUAL NRA CONVENTION

FORTY RESOLUTIONS, many of them relating to operations of the Bureau of Reclamation, were introduced during the final session of the 3-day Nineteenth Annual Convention of the National Reclamation Association at Spokane, Wash., Wednesday, November 15 through Friday, November 17, 1950, one of the most heavily attended conventions in recent years.

Among the important speakers were Senator Guy Cordon of Oregon who spoke on "Sound Reclamation Development," Senator Arthur V. Watkins of Utah whose talk was entitled, "Local Ownership and Control Versus Federalization," Maj. Gen. Lewis A. Pick, Chief, Corps of Army Engineers who talked on "Our Resources and the Future of America," and Representative Wayne Aspinall of Colorado who spoke on "Reclamation—Yesterday, Today, and Tomorrow."

Dillard B. Lasseter, administrator of the Farmer's Home Administration, spoke on "Credit Needs for the Small Farms in Reclamation Areas," H. P. Singleton, superintendent of the irrigation-experiment station at Prosser, Wash., spoke on "Agricultural Research in the Columbia Basin Project," Roger Fleming, secretary-treasurer of the American Farm Bureau Federation, titled his speech, "A Look Ahead," Harold T. Nelson, Director of the Bureau of Reclamation's Region 1 with headquarters at Boise, Idaho, told of "The Challenge of the Columbia River Basin," John Geoffrey Will, secretary and general counsel for the Upper Colorado River Commission, Grand Junction, Colo., spoke on "The Upper Colorado River Commission," and Kennard Cheadle, former chief counsel of the Bureau of Reclamation spoke on "Basin-wide Reclamation Development."

Commissioner of Reclamation Michael W. Straus discussed "Reclamation's Programs and Problems," on Thursday which was water users' day, presided over by Val Kuska, agricultural development agent of the Chicago, Burlington and Quincy Railroad Co., Omaha, Nebr.

A "grass roots" discussion was held following Commissioner Straus' speech lead by the following: Cecil C. Clark, farmer and horticultural leader on a small farmer-operated ditch and also on the Roza division, Yakima project, Wapato, Wash.; George M. Skoegard, president of the Fresno irrigation district, Fresno, Calif.; R. D. Searles, president of the Salt River Valley Water Users Association, Scottsdale, Ariz.; Royden G. Girling, president of the North Fork water conservation district, Lazear, Colo.; N. B. Phillips, manager of the El Paso County water improvement district, El Paso, Tex.; H. C. Gardiner of Anaconda, Mont., manager of the Mount Haggin Land & Livestock Co., and E. O. Daggett, manager of the farmers irrigation district, Scottsbluff, Nebr.

During the course of Commissioner Straus' speech, in which he gave a report of the accomplishments of the Bureau of Reclamation and summarized the present program with regard to the international situation, he pointed out and clarified several basic Reclamation policies.

Regarding soil conservation, he said, "You are hearing a lot about watershed control and soil conservation these days. I see no reason for any Reclamationists to be critical of watershed control or soil conservation. They should support them both to the limit—the Bureau certainly does. We do because we believe they are necessary and good for the West, but we also do for more selfish reasons. If there is not better watershed protection and soil conservation practice, the good reservoirs we build to save and hold water lose space to silt faster than necessary. Reclamation wants that soil and silt held on the watershed and not running into our reservoirs and it is just as simple and selfish as that. But the way to meet that problem is to speed up soil conservation and watershed protection practice and not to hold back the pacemaker, which is Reclamation."

"The same approach should be made in meeting the viewpoint of the fish, recreation, and wildlife groups," he said, explaining that "there is rarely

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TALL TIMBERS TOPPLED by ball and chain. *Photo by the Author.*

HIGHBALL for HUNGRY HORSE

by JACK CRISWELL

Hungry Horse Project, Montana
Region 1 (headquarters at Boise, Idaho)

YOU PROBABLY HAVE HEARD about the fellow who went to the circus for the first time, and seeing a giraffe eating leaves off tree branches 20 feet in the air, said unbelievingly, "Shucks, there ain't no sech animal."

Writers, photographers, contractors, and engineers express much the same reaction when they first see the amazing "highball" clearing method pioneered this year in the 24,000-acre Hungry Horse reservoir area in northwestern Montana. One writer for a national magazine declared, "I heard about it and didn't believe it. Now, I see it, but I still don't believe it. It can't be done."

Actually, the new land-clearing method, which uses teams of powerful Diesel tractors towing up to 2,000 feet of heavy wire rope with a gigantic 8-foot diameter steel ball fastened into the line midway between the two tractors, has been so fantastically successful that the system may well revolutionize the clearing industry.

Product of the imagination and engineering know-how of the two major clearing contractors working in the big Bureau of Reclamation reservoir, the new land-clearing method has been aptly named "operation highball," not only because of the 4½ ton steel balls used, but also because the mechanized scheme clears timbered land at a rate rivaling the legendary feats of Paul Bunyan.

Although the revolutionary idea was tried for the first time just last May, the almost unbelievable speed and efficiency achieved with the new snagging method have already attracted widespread interest among logging and clearing contractors. The unique and spectacular nature of the "highball" snagging operation has also attracted great public attention, and as a result it has been filmed by a national newsreel company, and has been written up in a great many of the national construction magazines and trade publications. Popular Mechanics magazine, for one, carried a comprehensive article in the August 1950 issue, and also used a painting of the tractor, cable, and ball set-up on the front cover.

The men who developed the revolutionary clearing method and are using it to snag down the timber on the steep mountain slopes and valley floor of the Flathead River's south fork in northwestern Montana are S. L. "Red" Wixson of Wixson and Crowe, Inc., and John Trisdale of J. H. Trisdale, Inc., both of Redding, Calif.

Basically, the "highball" clearing idea is a refinement on a very effective mechanized clearing method developed and used last year by the two contractors, in which pairs of Diesel tractors were used to drag up to 400 feet of 2-inch wire cable through the timbered areas, snagging down all of the trees, snags, and brush caught in the loop of the cable.

Working largely in burned over areas last year, the contractors found the cable snagging method

SIAMESE CAT, above, clears about 1 acre of debris per hour. The pull of heavy timber is so great on tractor (at right), operator must drop dozer blade on stump to prevent skidding. Photos by *A. E. McCloud, Region 1.*

so efficient that they were able to complete about 95 percent of their joint contract for clearing 7,210 acres of land before winter stopped operations. However, land being cleared under new contracts awarded last December—6,840 acres to Wixson and Crowe on a bid of $2,446,850 and 7,855 acres to Trisdale on a bid of $2,484,360—is mostly in areas from which merchantable timber has been removed by logging contractors. Recognizing that the cable would hang up on the stumps left by the loggers, Wixson and Trisdale put their imaginations to work and came up with the idea of using the 8-foot diameter steel balls to keep the the cable high enough above the ground to prevent snagging on stumps.

Effectiveness of the big steel balls in increasing the efficiency and speed of clearing operations has surpassed the most optimistic estimates of the contractors. Not only are the balls accomplishing their primary purpose—elimination of cable hangups on stumps—but the additional leverage applied by catching the trees several feet above the ground instead of at the ground level has speeded snagging operations to an amazing extent. Working on fairly level ground under ideal conditions, one pair of tractors pulling one ball actually snagged down in 4 hours all of the trees on a heavily timbered area of nearly 200 acres. Average daily production for one pair of tractors and one ball working under varying conditions, including steep hillsides, marshy ground, etc., has been close to 100 acres per 10-hour shift.

As a result of the speed of the "highball" snagging method, the two contractors were able to complete approximately 60 percent of their new contracts in just over 7 months of work, and it is anticipated that the entire clearing job will be finished by December 1951—more than a year ahead of the scheduled completion date.

Although the "highball" clearing method was an entirely new and untried idea, Wixson and Trisdale had enough faith in their brain child to gamble a small fortune on its success. Their combined bids were nearly $2,000,000 under the first bids submitted for the clearing work. The original bids were rejected because they were too much above the engineer's estimate. As soon as the contracts were awarded to them, the two contractors moved swiftly to translate their revolutionary idea into the new type of clearing equipment. Five steel balls were fabricated in halves out of ¾-inch boilerplate steel by the Consolidated Western Co. of San Francisco. Installation of 6-inch steel shafts in Timken roller bearings and final welding of the 8-foot diameter, 4½-ton steel spheres were done in the Redding, Calif., shops of the two clearing contractors, and the balls were then trucked to the reservoir area.

First experiments in use of the new equipment indicated that the fastest and most efficient set-up consisted of one ball pulled by a pair of tractors. In making a snagging "pull" the two tractor operators bulldoze their way through the forest on approximately parallel paths 100 feet or more apart—the distance between the tractors varying with the type of terrain and the size of the trees to be snagged down. In light going, the tractors move through the timber snagging down the trees caught in the loop of cable as they progress. How-

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'TWAS A GREAT DAY for Lewiston Orchards when the domestic water treatment plant (above) went into operation. Reclamation and Lewiston Orchards Irrigation District officials inspect filter bed at right. *Photos by Stan Rasmussen, Region 1 photographer.*

"Drinking" Water

by H. Q. CLARK, Chief Clerk, Lewiston Orchards Project, Idaho, Region 1 (headquarters at Boise, Idaho)

When Harry Isaman, President of the Lewiston Orchards Irrigation District, moved the remote-control level which sent raw water gushing into the domestic filters, he opened a new era for residents of the suburban area near Lewiston, Idaho. For over 40 years the water users had endured the hardships accompanying drinking water which varied in color from a light gray in the winter to a chocolate brown during the seasons of heavy rain or runoff.

"Too thick to drink, too thin to plow," people said of the water when it became really dark. Housewives took their washing to the nearby town of Lewiston, Idaho, and husbands toted home precious gallons of drinking water to their families. The State of Idaho's Public Health Department condemned the Orchard's water as unfit for domestic use.

The first domestic water system constructed by the Bureau of Reclamation in the West as a primary purpose of a project, will change all that. The system, which went into operation on October 22, 1950, is complete with modern filtration plant and pipelines to serve the 1,500 homes and 4,000 residents of the 3,500-acre irrigation district. Water users celebrated the occasion with a ceremony and open house at the filter plant, at which the project was officially dedicated by H. T. Nelson, regional director for the Bureau in the Pacific Northwest.

Designed to serve an ultimate population of 6,000 with pure, sparkling drinking water, the treatment plant has a capacity of 1,300,000 gallons per day. First, lime and alum are added to the water. Then in an outside circular claríflocculator, 55 feet in diameter, most of the suspended particles settle out. Four rapid sand filters within the plant complete the process of removing foreign matter. The water is then chlorinated and ammoniated, piped out to a 1,500,000-gallon capacity, concrete-covered, reservoir, and is ready for delivery to Lewiston Orchard's homes.

Not all of the water used in the district, however, is filtered and treated. Two completely separate pipe systems are installed, one to carry the filtered domestic water, the other to carry raw water for irrigating 3,800 acres of land which in the past has suffered serious water supply shortages. Each tract or homesite has two connections, one for domestic water, the other for irrigation. Because of the steep terrain and small size of most of the ownerships, irrigation is done almost enirely by sprinklers. A minimum 50-pound pressure is maintained in the irrigation mains.

Newcomers to the area are quick to see the advantages of the new system. Four hundred new homes have been built in the irrigation district since 1948, according to Walter Hereth, district manager. Most of these are on small tracts of one or two acres each, for part-time farmers or city folks who feel they need more elbow room.

The works of the present district were first built by private interests in 1906. Wooden flumes were used for diversion, and wood pipe was laid for the distribution system. The same water was used for domestic as well as irrigation purposes.

The system gradually deteriorated, losses ranging from 12 to 85 percent from section to section of the system. Pressures were inadequate for satisfactory delivery of domestic water to many homes, and, in addition, portions of farm units were left dry, due to an inadequate water supply. After tremendous effort by local people, the Congress in 1946 approved a Bureau of Reclamation plan for reconstructing all the facilities, including the replacement of the diversion works and flumes with modern concrete structures, and the installation of separate irrigation and domestic distribution systems to replace the old deteriorated wood pipelines.

Work was begun in September 1947, and initial water delivery was made in October 1950. The project cost $2,500,000, which will be entirely repaid by the water users over a 50-year period. As such, it is one of the few new projects that can be entirely repaid by the water users, others having to depend on power revenues or nonreimbursable costs. Upon completion of the project, it will be turned over to the irrigation district to operate, in conformance with Bureau policy.

Regional Director Nelson was enthusiastic about the completion of the project when he addressed the thousand people gathered at the plant for the dedication ceremonies. He said the Bureau of Reclamation did not look upon the celebration as a mere gathering of a few people around a new water-treatment plant.

GONE ARE THE DAYS when inadequate water supplies caused dry spots on Lewiston Orchards farms. Wilbert Tressler and his son Lawrence stand in the luxuriant lettuce growth on the John Chemanti farm, insured against drought by the Bureau of Reclamation's renovation of the irrigation system. *Photo by Stan Rasmussen, Region 1 photographer.*

"To us," Mr. Nelson said, "this ceremony is symbolic of the steady progress that the Pacific Northwest is making toward assuring full, orderly development of its land and water resources. It is symbolic of the strengthening of the Nation through the building of prosperous, virile American communities."

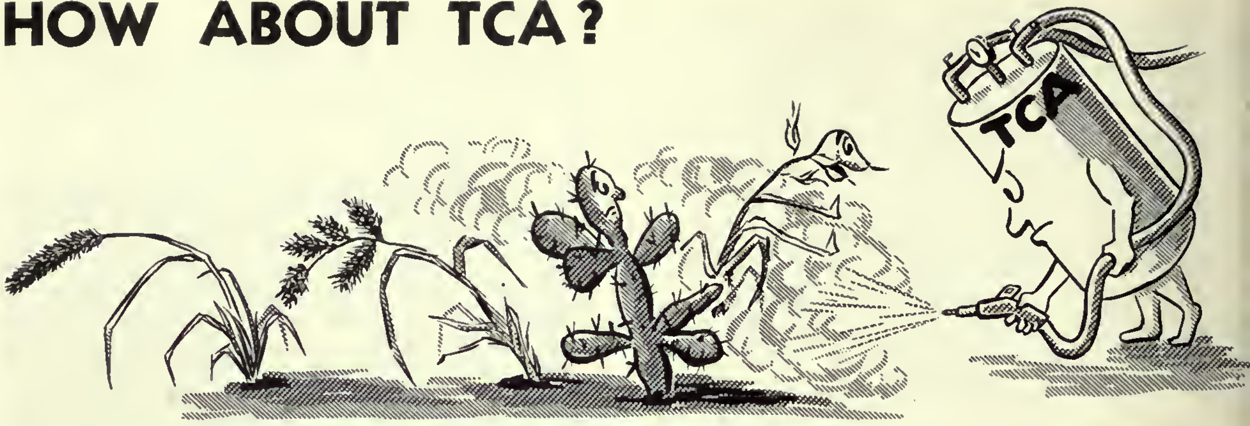
Orchards residents are enthusiastic about their new kind of drinking water. At the dedication ceremony, Board Chairman Isaman proposed that the first glassful from each kitchen tap be drunk to the health of Construction Engineer W. L. Karrer, who supervised the work. And each glassful drunk from that time on will be a toast to the health of the Lewiston Orchards people, too! THE END.

Savage Receives New Honors

John Lucian Savage, "the billion-dollar engineer," also known as the "water resources engineer to the world" and the recipient of perhaps more honors in his field than any living engineer, has again been honored. This time, he was awarded the Interior Gold Medal for Distinguished Service by Secretary of the Interior Oscar L. Chapman on September 15, 1950. On November 29, President Truman appointed him a member of an 11-man advisory committee on the Point 4 program. Chairman of the committee is Nelson Rockefeller.

For the complete story of Mr. Savage's amazing career see "Reclamation's Hall of Fame—John Lucian Savage," p. 91, RECLAMATION ERA, May 1950. ●

HOW ABOUT TCA?



A New Weed Killer for Grasses

by ROBERT B. BALCOM, Chief Agronomist, Branch of Operation and Maintenance

A YEAR OR TWO AGO very few people had heard of TCA. Nearly every one has heard of 2,4-D, which takes care of many broadleaved plants. But what to do about the grassy weeds?

Federal, State, and commercial weed control researchers heard the plea of farmers, irrigation officials, and others to find something that would kill superfluous grass and not sterilize the soil for a long period.

They have tested hundreds of chemical formulas, but one of the most promising is TCA whose grass-killing properties were first demonstrated by DuPont's Pest Control Laboratories. TCA is the abbreviation for trichloroacetic acid. Several chemical companies manufacture the herbicide and you can buy sodium TCA at most stores selling weed control supplies. Most people add water to the sodium salt and use TCA as a spray.

TCA VERSUS JOHNSON GRASS, below. Foreground was treated. Background of lush grass, as yet untouched by TCA, dramatically illustrates the contrast between treated and untreated stands. *Photo by Harry Meyers, Region 3 photographer.*

Although the new herbicide is quite selective, affecting grasses more than most broadleaved plants, it is not as selective as 2,4-D, which has little effect on plants in the grass family, including cereals.

All irrigation projects are plagued with problems caused by annual and perennial grasses on crop land or ditchbanks. Foxtail, squirreltail, cheatgrass, wild oats, and numerous so-called watergrass are examples of annual grasses. While they are pestiferous and cause crop reductions and maintenance problems you can control them easier than perennials. Some of the worst perennial offenders are the reed grasses, called carrizo cane, in the Southwest, and a wheat grass called quack grass, quitch grass, and couch grass. Several others come in for their share of unprintable adjectives, but perhaps the most troublesome of all is Johnson grass.

On some of the projects in the Southwest, Johnson grass is the worst weed, barring none. Therefore it is only natural that Fred Arle, agronomist for the Bureau of Plant Industry, Soils, and Agricultural Engineering, in charge of the weed research project at Phoenix, Ariz., has devoted considerable of his efforts to Johnson grass control. This is a part of the BPI's weed research program conducted cooperatively with the Bureau of Reclamation.

Many of the State college experiment stations also have been testing TCA on grasses with various results, but agree that it *is* effective on Johnson grass. Drs. Alden S. Crafts and W. H. Harvey of the California Station at Davis report that experiments indicate that a spray treatment which is followed by rains that wash the chemical into the soil may be most effective. Also, there is some indication that after spraying, the chemical is translocated into the underground rhizomes (creeping underground stems) of Johnson grass. They have found TCA effective on perennial grasses at rates of from 20 to 100 pounds per acre, depending upon the species of grasses. Most research workers recommend the higher rates for Johnson grass.

The California station also reports that spray applications at rates around 5 pounds per acre seem promising for controlling watergrass (an annual) in cotton and sugar beets, but had not conducted sufficient tests to make general recommendations. Other stations also have reported good success when low rates were used for annual grass control in certain crops, and the method merits further testing and research.

Kansas State College, in its circular 255, entitled, "Control of Obnoxious Perennial Grasses with the Trichloroacetates," summarizes its work as follows:

1. Trichloroacetates can be used to control noxious perennial grasses when applied at rates of 80 to 150 pounds per acre.

2. Annual grasses are controlled readily by dosages ranging from 20 to 60 pounds per acre applied as a foliage spray.

3. Treatment of the soil with TCA will prevent the growth of grasses arising from seed in the soil. The chemical, therefore, holds some promise for control of weedy grasses by pre-emergence treatment.

4. Prickly pear cactus plants have been eliminated completely by spraying with a solution of ½ pound of TCA to 1 gallon of water.

5. Shallow rooted grasses can be controlled most successfully by applying TCA to the soil after removal of the top growth. Grasses with deep root systems are controlled more successfully by foilage applications.

6. The moisture content of the soil has an important influence upon the effectiveness of soil applications of TCA. It also affects the duration of soil sterility.

In the fall of 1949, the weed crews on the Yuma project, in cooperation with C. W. Bowser of the regional office and Mr. Arle, used about 3,000 pounds of TCA at a rate of 120 pounds of 90 percent material applied as a coarse spray on Johnson grass and carrizo cane. The Johnson grass was reduced by 90 to 95 percent in sections of ditch where the banks were not disturbed throughout the season. Only about 40 to 50 percent eradication resulted where the canal was dredged or where the grass was burned during January or February. TCA retarded the growth of the carrizo cane until late summer, but did not reduce the number of plants. A. E. Simmons, superintendent of the Palo Verde district, applied 1,500 pounds at the rate of about 90 pounds of TCA per acre. Regrowth occurred, mostly from shallow rhizomes, but the Johnson grass was greatly thinned out.

An interesting sidelight on the use of TCA was the discovery made by Oscar Fudge, of the Imperial irrigation district. When he added TCA to 2,4-D the combination was effective in the control of cattails. On one area he obtained 100 percent kill with one application. This method has since been tested by the BPI weed-research stations and in the Bureau's regions with varying results. However, in most cases they have found that TCA plus 2,4-D gave better results than 2,4-D alone. More testing is needed on this method before general recommendations can be given.

Coming back to Mr. Arle's work with Johnson grass in the Salt River Valley, he found that around 100 pounds of TCA per acre resulted in almost 100 percent kills. To be on the safe side, some weed leaders are recommending 120 pounds per acre of the product as it is obtained from the

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A GOOD TEAM for getting rid of cattails—TCA and 2,4-D, pictured at right. ***Drawing by Graphics Section, Washington, D. C.***

SPOTLIGHT ON MINIDOKA FAMILY

Old-timers and new settlers on Bureau of Reclamation projects should get many a reminiscent chuckle or sigh from the story of the Roland Powers family which was selected by the Ladies' Home Journal in October 1950 for feature treatment in their How America Lives series.

"Homesteaders 1950" starts out with the following paragraph:

The yearning of men and women for land of their own is as old as history. This irresistible drive impelled generations of earlier Americans to leave comfortable surroundings for the hazardous trek westward. The right of pioneers to stake claims to public lands was first legally recognized when Abraham Lincoln signed the Homestead Law in 1862. The spirit of that law remains in effect today, and the urge to blaze fresh paths in the wilderness is still strong. As our frontiers have closed, new homesteads have been carved out of vast areas reclaimed from the West's arid deserts. Since the war, the Interior Department's Bureau of Reclamation has opened more thousands of irrigated acres to veterans chosen by lot, with 3 years of proved farm experience (after the age of 15) and with assets of $3,000. The lucky ones have 5 years to prove their patent to the land. Typical of the thousands of recent homesteaders engaged in creating a home and a livelihood from the desert sagebrush are Edith and Roland Powers, of Idaho. This is their story.

The story of the Powers family tells the familiar tale of a young couple trying to get a start on an irrigated farm. How the Powers are proving claim to 160 acres of Idaho's Magic Valley land includes the disappointment of Roland Powers when his name was not selected at the drawing, his elation when one of the chosen applicants dropped out and he was given another chance, the second disappointment when the land he thought would be his turned out to be another's and his downright despair when he was given a rocky, unbroken tract. The hand-me-down furniture from the WRA encampment, the 2½-mile walk to the mail box (later shortened to a ½ mile) the trip to the 5- and 10-cent store, the jackrabbits, rattlesnakes, ditch mud, and blowing dust are all there. His first experience at irrigation is well worth quoting:

The only magic in the Magic Valley is the water. To reach the Powers land, it must flow 27 miles from the point where the canal leaves the Snake River. That first hopeful spring when the liquid magic gurgled down the canals, Rolly thought he was ready. He had painstakingly "set" his best fields according to verbal instructions. But words cannot assess in advance what a given flow of water will do in a new ditch on an unmeasured grade.

The water nearly washed them out. At 4 a. m. Rolly was in the fields, checking the head ditch, the stilling basin, and the dozens of corrugates, or small trenches supposed to distribute the water evenly through the planted fields. As he stood there, his heart pounding wildly, a center ditch washed out. Furiously Rolly shoveled to patch it, then dashed inside to gulp his breakfast. When he came out, the trench was spilling over again.

Thus it went all day, seven separate washouts, the final one at 11 that night. "When the water is running," Rolly learned, "you can't turn your back even to eat. It'll wash everything away unless you're right there packing a shovel."

When Rolly dragged himself home that night, his face was blacker than coal and he ached in every muscle. He was not only dead beat, he was disgusted and ready to call it quits. "I'm no farmer," he told Edith. Listening while he berated himself, Edith realized it was up to her "to turn Rolly around."

His hands were so swollen and cracked from "handling the water" that he couldn't bend them. Edith tenderly coated on Vaseline and wrapped the puffed fingers with torn sheets. Lovingly she soothed his weary anguish, insisting that he not blame himself for inexperience, that everyone had a lot to learn. Presently Rolly fell asleep in her arms. Next morning when he awoke, full of good cheer and fresh resolve, Edith knew she had accomplished "what a wife must do—make her husband understand she has not lost faith in him."

The Ladies' Home Journal gave the RECLAMATION ERA permission to reprint extracts from this moving account of one of the homesteading families on a Bureau project. There is an unhappy sequel to the story behind the story, however. We learn that Richard Lauterbach, the author who wrote so understandingly of the Powers' struggles, died of polio in October. He will be well remembered by the Bureau and the people around Minidoka for his insight into the problems of homesteading and his graphic account of a typical young American family.

Here are his two concluding paragraphs:

The two men who know most about the homesteaders' prospects, Chenowith and Sandberg, [*Vern Chenowith and Sandy Sandberg of the Farmers Home Administration.*—Ed.] *have faith that the Powerses will get patent to their land in a year or two. Thus far Rolly has had no trouble meeting requirements of the Homestead and Reclamation Laws. His crop this year should gross about $7,000, above average. With another loan from Sandberg (this one under a recently approved low-interest 40-Year Farm Development Program), he hopes to "get out from under a bit." To do this, he plans sprinklers instead of ditches for certain fields, more leveling, erection of fences, and the purchase of six milk cows. Gradually, Rolly will shift his farm's emphasis to dairying so that when the GI school income terminates next year the family will have another source of revenue.*

After the water is shut off this year, Rolly intends to put a solid foundation under their hand-me-down house, insulate it, install the furnace and bathroom, cover the rugless floors, and, in general, pay more attention to living. "We've got to make an investment in comforts now," Rolly says. "Gosh, you gotta live. You only live once. I don't know how we're gonna do it, but we'll sure try."

And Edith, her eyes warmly reassuring him, adds, "That's all anyone can ask; isn't it?"

THE END.

TAKING INVENTORY, below. ON THE JOB, at lower right. Photo of ex-school teacher Powers below by Stan Rosmussen, right photo by Phil Merritt, both of Region 1.

CUT THE COSTS

by G. S. ELLSWORTH, Assistant to the Commissioner for Management Planning

Plagued by the same increasing costs that concern the woeful housewife and affect the balance sheets of business, large and small, the Bureau of Reclamation is concentrating on a program of unprecedented magnitude to find ways and means of securing greater economy and efficiency in its operations—and to put them into effect.

"Reduce the costs of doing business" is the current and continuing tocsin and watchword, and every Bureau employee has been enlisted in the campaign. On every job—in every office—Bureau employees are subjecting their work and practices to hypercritical analysis and meeting with special committees of their fellow workers to discuss and decide upon changes and improvements that will cost less and accomplish more in the same or less time.

Commissioner Straus placed the problem in perspective in his remarks before Reclamation leaders during the Santa Barbara conference in July, as follows:

"[With Reclamation's growth], your responsibilities have multiplied. Where in years gone by, loose practices, procedures, or policies might have wasted 5 pennies of a nickel—by comparison, because of Reclamation's growing program, now they would waste the 20 nickels of a dollar. The public, the national, and Reclamation's own internal check-up and accountability will, inevitably, and should, without fail, increase in similar proportion. It already has."

Previously, congressional committees considering the fiscal year 1951 general appropriation bill had reflected impatient concern with the increased costs of Federal Government operations, particularly personnel costs. In the case of the Bureau of Reclamation, Senator Carl Hayden, chairman of the Interior appropriations subcommittee, agreed with Assistant Commissioner Lineweaver that the Bureau's past and continuing efforts could produce the necessary results if prosecuted vigorously, and the Senate appropriations committee contented itself with instructions to the Commissioner "to continue his examination" of personnel and organizational requirements. The committee further requested that a report be submitted "at the next session of Congress as to what has been accomplished along this line."

Arrangements for the currently intensified efforts to "reduce the costs of doing business" were crystallized at a conference in Washington during October of representatives of the Bureau's regions, branches, and offices. The meeting was sponsored by Assistant Commissioner Nelson and conducted by the Commissioner's Office of Management Planning. The conferees adopted the methods previously employed by Region 7 in pilot studies of "costs of doing business" which, briefly, provide that the work of every employee shall be analyzed and that special committees should be established to review objectively and critically all procedures, practices, and activities "to eliminate 'excesses' in our operations, and to bring staffing squarely in line with essential programed work."

The Commissioner has instructed all office heads to effect without delay any improvements or changes within their authority and to submit to him before January 1, 1951, the recommendations of their organizations for improvements or changes in Bureau operations requiring action by the Commissioner. Simultaneously, the Commissioner designated the three Assistant Commissioners as a special committee "to review all procedural changes recommended (for action by the Commissioners) to assure objective, impartial analysis and recommendation."

The program of cost reduction extends to all phases of Reclamation's activities: to operation and maintenance which directly and currently affects nearly 100,000 water users on projects in operation, to the planning and construction of new projects, and to overhead or administrative expenses wherever incurred—in Washington, Denver, regional, or project offices.

And in the words of Commissioner Straus again, "it is always in order that we frequently take stock of ourselves and our effort with our own most advantageous and intimate knowledge of Reclamation . . . and it is in order that we do so frankly and without sparing ourselves of warranted criticism."

Reclamation's people are responding—by action and deed. The End.

Central Valley's Flood Lesson

BULWARK OF THE NORTH—Shasta Dam. *Photo by A. E. McCloud, now in Region 1.*

A week before the rivers of California went on a rampage last November, Secretary of the Interior Oscar L. Chapman announced that comprehensive legislation for California water control and flood prevention had been submitted, with Presidential approval, to the Congress of the United States.

As the November 1950 flood reached its crest, and earned the title of the worst flood in California's history, Shasta Dam's Reservoir in the upper reaches of the Sacramento River in the north, and Friant Dam's Millerton Reservoir in the upper regions of the San Joaquin River near the southern end of the Central Valley, swallowed completely that part of the melted snowpack from the High Sierras, which cascaded down the mountain canyons into the reservoirs behind their waiting concrete-and-steel barriers. In fact, these two reservoirs gobbled up all the water coming their way with room to spare.

During the peak of the storm, which caused flood damage estimated at $10,000,000 in the San Joaquin Valley from Saturday, November 18, through Monday, November 20, Friant Dam stopped the entire peak of the San Joaquin flow of 45,000 cubic feet of water per second. While that amount was rushing into its reservoir, Millerton Lake, only 50 cubic feet of water per second was permitted to trickle into the river below the dam. At the end of the operation ample space remained to trap additional surplus water during the winter. Besides relieving the flood pressures from tributary streams below Friant Dam, 1951's irrigation water for the great agricultural San Joaquin Valley was saved for future use during the dry season, 123,000 acre-feet of water being added to the storage supply.

BULWARK OF THE SOUTH—Friant Dam. *Photo by Ben Gloho, Region 2's Chief Photographer.*

Shasta stored 118,000 additional acre-feet of water during the week. Had Shasta not been built, this water would have fed into the Sacramento River, already swollen by heavy floods from tributaries below the dam. By catching the waters in the north, Shasta saved the city of Sacramento, where the Sacramento and American Rivers meet, from even worse damage than it sustained. Although the 206,000 second-foot flow of the American River was the largest on record, the citizens of Sacramento were spared the complete devastation which would have resulted had the two rivers reached flood crest at the same time.

The water stored by Shasta will also be available for hydroelectric power, irrigation, and domestic use in the coming dry, summer season. Space still remains behind Shasta to catch additional winter floods.

The major damage caused by the floods was from tributary streams below Friant and Shasta Dams, furnishing both a demonstration and an object lesson of the worth of multiple purpose structures for control, development and integration of water in California's Central Valley.

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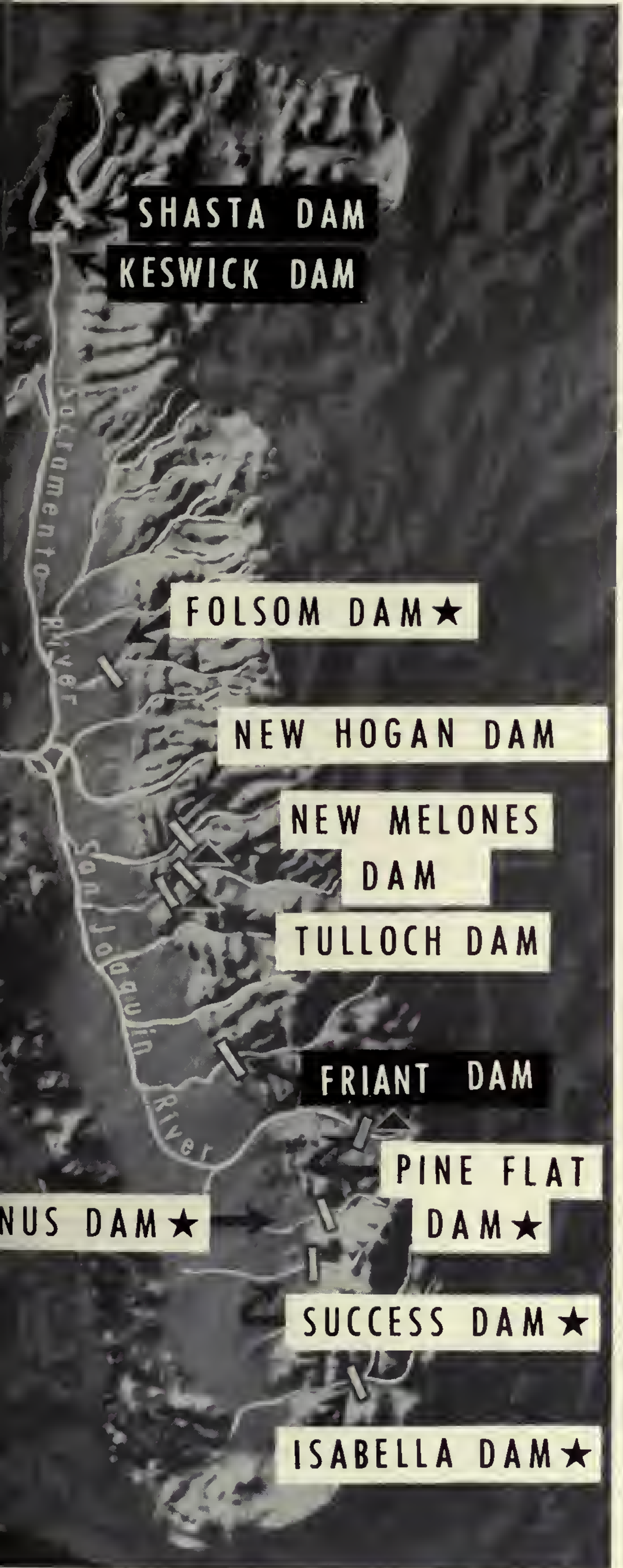
SHASTA DAM
KESWICK DAM
Sacramento River
American River
FOLSOM DAM★
Sacramento
Stockton
San Joaquin River
FRIANT DAM
PINE FLAT DAM★
Fresno
ISABELLA DAM★
Kern River
Bakersfield
N



PROOF OF PROTECTION—At far left, showing how the flood waters poured into the trough of Central Valley, and how Shasta and Friant fulfilled one of their multiple purposes. PLAN FOR PROTECTION PLUS—At center, indicating the locations of the proposed structures which would work together for flood control, irrigation, municipal water supply, hydroelectric power production (power plants indicated on map by triangles), and other benefits to the people of California. Stars indicate dams to be constructed by the Corps of Engineers. *Illustrations by the Graphic Section, Washington, D. C., office of the Bureau.*

The structures completed by the Bureau of Reclamation, Shasta Dam and Reservoir, Keswick Dam and power plant, Friant Dam and Millerton Lake, which functioned with 100-percent success during the emergency, are the first steps in the comprehensive program for California's water control, conservation, and use.

The Bureau of Reclamation's canal system for the Central Valley project, also part of this plan, sustained virtually no damage. Two structures under construction by the Army's Corps of Engineers were damaged by the flood, Folsom Dam on the American River and Pine Flat Dam on the Kings River near Fresno. Pine Flat Dam was first authorized by the Secretary of the Interior on February 10, 1940, and 10 years ago, the Bureau of Reclamation and the Interior Department sought appropriations to start its construction.

Efforts at developing a comprehensive plan for the Central Valley date back to 1873 when the Army engineers prepared a report on irrigation in the San Joaquin, Tulare, and Sacramento Valleys. Since then many reports, detailing and enlarging on the plan, have been prepared by Federal and State agencies. The Bureau of Reclamation participated in these studies almost from the time of its formation in 1902.

The so-called initial units of the over-all plan for water development within the basin were first defined in a report issued by the State in 1930 entitled, "State Water Plan." Although there have been changes in some of the engineering designs, the initial units proposed in the State report are essentially those which have been or are being built by the Bureau of Reclamation.

Senate Document 113 entitled "A Comprehensive Report on the Development of the Water and Related Resources of the Central Valley Basin for Irrigation, Power Production, and Other Beneficial Uses in California, and Comments by the State of California and Federal Agencies" was submitted to the Eighty-first Congress in August 1949.

The proposed authorizing legislation submitted

(Please turn to page 20)

THE STORY OF ENDERS DAM

Based on material submitted by U. V. Engstrom, former construction engineer for Enders Dam, now construction engineer of Grand Lake, Colo., and Donald B. Thompson, draftsman and reports writer, Enders Dam project office, Nebraska Region 7 (headquarters at Denver, Colo.)

Aerial view of Enders Dam, by L. C. *Axthelm*, Region 7 photographer.

At 10 a. m., on October 24, 1950, a blast of dynamite shook the earth near the town of Enders in southwestern Nebraska.

Harry D. Strunk, president of the Republican Valley Conservation Association, member of Reclamation's Hall of Fame (see p. 195, September 1949 issue of the Reclamation Era) had given the signal for the explosion, which dramatized another giant step toward security and prosperity in the Missouri River Basin.

The occasion, witnessed by about 1,500 persons, was the "plugging" of Enders Dam, the first irrigation, flood-control, silt-control dam to be started by the Bureau of Reclamation as part of the Missouri River Basin project.

While Enders Dam was under construction, Frenchman Creek flowed through a large concrete conduit. The contractors installed this huge pipe early in construction to avoid building cofferdams or other works to detour the river around the construction site. As a result, the river has become accustomed to its underground route through the dam for some time. The water entered the conduit through a temporary opening low in the base of the trash rack, or permanent intake structure.

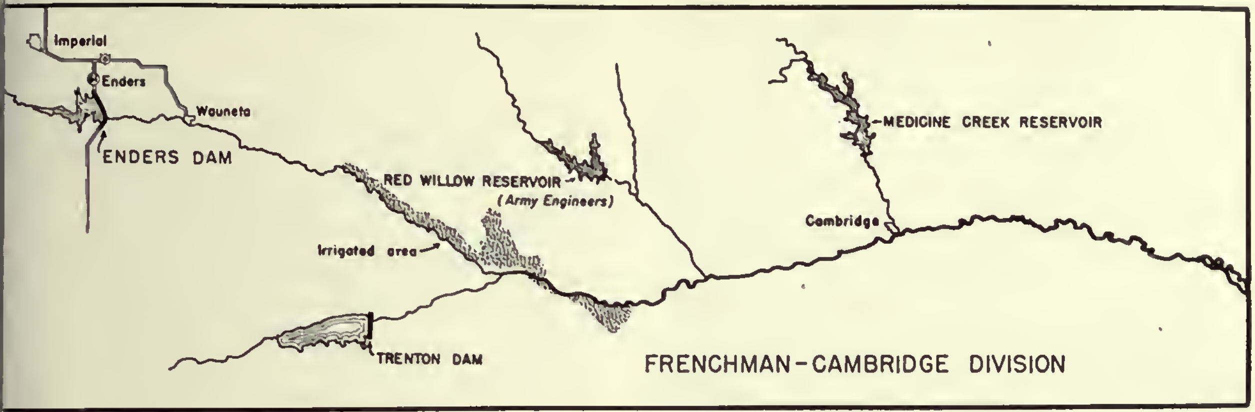
All but the finishing touches on the dam were completed several months ago, but closing this temporary water route was delayed until October to protect the rights of downstream water users.

Several days before the ceremony of plugging the dam was scheduled, the flow of water from west of the dam was reduced as much as possible by shutting down outlets from reservoirs and lakes. In addition, two small dikes were erected a short distance upstream, to hold back the flow of the river, so that workmen could put the wooden concrete forms in place ready to receive the final batch of concrete which would seal the opening.

Before the rumble of the explosion had died, the first bucket of concrete was swung into position, and Harry Strunk and "Hub" Robinson (H. E. Robinson, district manager for the Bureau of Reclamation's Kansas River district) pulled the trip on the concrete bucket, releasing the first batch. An hour and a half later, Enders Dam had been "plugged."

When the water rises 40 feet higher in the reservoir, it will enter the upper part of the intake structure, shoot down into the conduit again, and resume its subway trip to the other side of the dam and its outlet works.

Thus was a cycle completed. Construction began on Enders Dam on March 26, 1947. On May 29, 1947, Harry Strunk also presided at the dam's dedication ceremony which was attended by 12,000 people. At the closure ceremonies, Kenneth Sweeney, Enders merchant, served as master of ceremonies, Reverend Wilber R. Hoover of Enders offered the invocation, and "Hub" Robinson made the principal speech, emphasizing the benefits to the people living in the area surrounding the dam, and concluding his message with the statement, "It is surely going to be a safer, more desirable, and more enjoyable place to live."



Short talks were also made by Harry Strunk, . B. Darnell, Enders businessman; J. C. Naylor, ublisher of the Imperial Republican; C. O. rane, acting construction engineer of the Enders roject; J. W. Olson of the contracting firm of laussen-Olson-Benner, Inc., and Roy Long, secetary of the Nebraska Reclamation Association. he Chase County High School Band was on hand or appropriate musical numbers, and representaives of the local V. F. W. and American Legion aised the colors.

While the final concrete was being poured, the rowd scattered over the project, in an informal open house" inspection. Many of them thought he most interesting feature was an underground rip to the gate chamber, nearly 100 feet below he crest of the dam. Other groups of sightseers bove ground were fascinated by the skill with hich steel crews played ball with red-hot rivets nd air hammers while putting the finishing ouches on the steel spillway gates. These gates—ix steel 30 by 50 radial "locks"—have been designed to handle more than 200,000 second-feet of ater. Hydrologists estimate this to be the possible peak flood-flow of the river. They also do not expect the reservoir to be completely filled except during flood emergencies.

LOSURE CEREMONIES at Enders Dam begin with raising of the olors, below. At right, Harry Strunk and "Hub" Robinson vearing felt hats) have just dumped the first bucket of concrete the closure plug at the dam.

It will take about 2 years for Enders Reservoir to fill to irrigation storage capacity. Now that storage has begun, the people in the area will soon see the lake rising gradually to its 6-mile length and its 31-mile shore line. In addition to its more utilitarian aspects, Enders Dam will provide one of the top recreation spots in western Nebraska. Facilities for fishing, boating, swimming, hunting, and picknicking are already under construction. Trees and shrubs planted in the area in collaboration with the Fish and Wildlife Service and the National Park Service last spring, have already made a notable growth. Besides beautifying the area, these plants will provide natural sanctuaries for fish and wildlife. (See article entitled "Tree Planting in the Missouri Basin," p. 161, August 1950 issue of the RECLAMATION ERA.) Several individuals and groups heave leased a number of cabin sites, and others like the local Isaak Wal-

ton League and the Wauneta and Imperial golf associations, are carrying out big plans for making Enders Dam their headquarters.

Tourists, as well as residents of nearby communities, will find a network of excellent roads leading to and from the dam. The reservoir is paralleled on the north and south by two paved Federal Highways, Nos. 6 and 34. State Highway 61 passes directly over the dam, joins these two major traffic routes, and also connects with Federal Highways Nos. 30 and 26 farther north.

If negotiations under way prevail, the recreational areas around Enders Reservoir will ultimately be administered by the Nebraska State Game, Forestation, and Parks Commission.

Recreation, and fish and wildlife protection however, are only two of the many benefits which the people of the area will receive as a result of the completion of Enders Dam.

Enders Dam is a working member of a four-dam team in the Frenchman-Cambridge division primarily designed for irrigation, flood control, and silt control. Red Willow Dam and Reservoir is to be constructed by the Corps of Engineers and integrated into the Frenchman-Cambridge division. The Bureau of Reclamation completed Medicine Creek Dam, 6 miles north of Cambridge, Nebr., on June 30, 1949, and will complete Trenton Dam, the largest of the three structures, situated 24 miles west of McCook, Nebr., on the Republican River sometime during the latter part of this year, or early in 1952.

The entire Frenchman-Cambridge division stretches from Enders to Orleans, Nebr., and includes 57,720 acres of land under the following canal systems: Cambridge, 17,300 acres; Red Willow, 11,410 acres; Meeker-Driftwood, 16,440 acres; Frenchman, 12,570 acres. Of the total, 12,350 acres, mostly in the Frenchman and Meeker-Driftwood areas, will be provided with supplemental water; the remaining acreage will be new development.

The project land area consists of a narrow strip 1 to 3 miles wide and 110 miles long. Enders, Medicine Creek, and Trenton, the Bureau's three storage reservoirs with earthfill dams, are being constructed for multiple-purpose use. Enders will have a storage capacity of 74,000 acre-feet. Of this, 10,000 acre-feet are set aside for sediment control and wildlife protection, 34,000 acre-feet for irrigation water, and 30,000 acre-feet for flood control and flood storage.

Benefits from the project development will not be confined to the irrigated area, however. When the valley lands are under irrigation, producing crops which are assured of a predictable supply of water, the large dry-farming area surrounding the irrigated farms will reap the benefits of a safe and sound agricultural economy. The three reservoirs will also protect the central portion of the Republican Basin from major flood disasters like those of 1935 and 1947. The addition of the three new man-made lakes in an area notably lacking such resources cannot be discounted in totaling the benefits of this development.

Enders is the largest of the earthfill dams in the Frenchman-Cambridge division—134 feet high, the dam itself is 2,603 feet long, with an additional dike over a mile long—6,421 feet in length, to be exact.

In constructing the dam, contractors moved almost 2 million cubic yards of earth, packing it down into the dam's structure. Where the dike section was to be raised, the ground had to be solidified. Technicians called it a "loess formation of low density," meaning that it was made up of loose soil, ranging from clay to sand, with much waste material like bones and shell which are often found in the Nebraska area. This type of soil structure was about 60 feet deep. Before the dike could be built, the contractors saturated the dike foundation by pumping 87 million gallons of water over the area, starting in March 1947 and completing the consolidation by the last of June that year. As soon as the foundation was sufficiently dry, the contractor started the work of placing the rolled filled embankment.

On the other hand, water had to be pumped out of the dam foundation. The design of the dam called for a cut-off trench (a solid-earth core to cut off the flow of water at the base of the dam) to be constructed across the valley floor and extend up each abutment to the top of the enbankment. Frenchman Creek was routed around the right abutment while the outlet works were being constructed, and the contractors struck water within a few feet of the ground surface throughout the river bottom. Open pumps and 2- to 6-inch centrifugal pumps dewatered the cut-off trench during July and August 1949.

Another problem connected with the construc-

(Please turn to page 20)

Highball for Hungry Horse

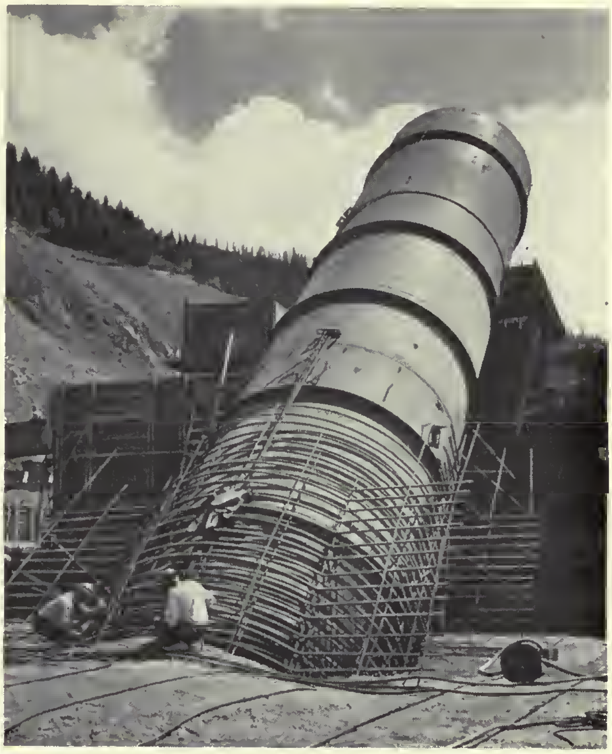
(Continued from page 3)

ver, in heavy stands of fairly large trees, the perators release the brakes on the tractor winches nd allow the cable to unreel as the tractors move head through the timber. When most of the able has been paid out, the operators anchor the ractors against convenient trees or stumps and eel in the cable on the powerful tractor winches. Vith both winches taking in cable at top speed, he ball and cable crash through the timber as fast s a man can walk, felling the trees caught in the oop of cable like a field of wheat before a terrific vind and hail storm.

The "highball" clearing method uproots practically all of the large trees. Dead snags and some of the trees snap off like matchsticks when struck by the ball or cable. Small trees are frequently only partially uprooted or are bent over without reaking. However, in bending the small trees, he cable scrapes the bark from one side of the rees, and as a result, they bleed and die quickly, urning brittle so that they are easy to stack and ourn.

After the timber is snagged down, teams of ractors with bulldozer brush blades move in to stack the trees and brush for burning. Here again, one of the contractors has devised a new and ingenious way of adapting standard equipment to meet special requirements. John Trisdale's 270-horsepower "Siamese cat," which is actually two standard D–8 Caterpillar tractors bolted together side-by-side with controls centralized for operation by one man, is doing the work of three single tractors. Equipped with a special 22-foot-long brush blade, the huge land-clearing machine bunches and piles downed timber and brush at an average rate of about 1 acre per hour.

The speed with which the big reservoir-clearing job is progressing has brought approving smiles to the faces of Construction Engineer Clyde H. Spencer and the members of his staff at the Hungry Horse project, for it means that the reservoir will be ready well ahead of time for storage of 1,000,000 acre-feet of water during the spring runoff of 1952. This storage will play a vital role in helping alleviate critical power shortage conditions in the Pacific Northwest by spinning the first two Hungry Horse generators, which are scheduled to go on the line in October and December 1952, and by firming up generating capacity at downstream power plants, including Grand Coulee and Bonneville on the Columbia River. Hungry Horse Dam will also make a sizable contribution to future irrigation downstream and control of Columbia River floods. THE END



DEFENSE STRUCTURE—As truly as if it were actually the giant coastal gun it resembles is this 13½-foot penstock pipe rising from the massive concrete blocks of Hungry Horse Dam in Montana. *Photo by A. E. McCloud, Region 1 photographer.*

Hungry Horse Concrete Pour Reaches New High

During the month of September 1950, concrete production at the Hungry Horse dam in Montana totaled 167,825 cubic yards, for a new high daily average for this project of 5,594 cubic yards. Without belittling this accomplishment, Grand Coulee Dam in May 1935 still holds the worlds unbeaten record concrete pour of 20,684¼ cubic yards of concrete poured in 24 hours.

The graveyard crew at Hungry Horse worked through extremely cold weather, however. During nine of the September nights the thermometer registered below freezing temperatures. •

How About TCA?

(Continued from page 7)

store. When you apply 120 pounds of the TCA products, which state they contain 90 percent active ingredient, you are applying 120×0.90 or 108 pounds of the material which actually does the work. If you desire to apply 100 pounds active ingredient you must figure on 100÷0.90 or 111 pounds of the 90-percent material.

Soil-moisture conditions play an important part in the effectiveness of this chemical compound because the best results are obtained when it soaks down to the roots. Mr. Arles' best kills resulted when a half-inch of rain fell about 2 weeks after the applications, and carried the herbicide into the soil. On the other hand, heavy rains have a tendency to leach the chemical out of the soil before it can do its work. In the Southwest, October sprayings have given much better results than those in spring and summer.

Some of the shallower rooted grasses are controlled most successfully with TCA when applications are made immediately after the top growth has been cut off. But Johnson grass, which has a comparatively deep-root system, has responded better when mowed, given a few weeks to regrow to a height of about 12 to 18 inches, and then sprayed with TCA.

Following Mr. Arle's findings, R. J. McMullin, irrigation manager for the Salt River Valley Water Users' Association, treated several miles of Johnson-grass-infested canal banks with 95 pounds of TCA per acre in October 1949. Only 1 to 5 percent regrowth appeared during the spring of 1950, and these small patches are being finished off with oil sprays. Mr. Arle has found that aromatic oils are effective for spot treatments of regrowth and for controlling seedlings which come up in the treated area. His findings for general control of Johnson grass with oils were reported in the March 1950 issue of RECLAMATION ERA. (See p. 58.)

TCA acts slowly and the roots may not decompose completely until the following spring. While TCA causes temporary sterilization, this period is comparatively short—an advantage on ditchbanks as well as in fields.

In using TCA certain precautions should be taken. The ammonium salt, which was used in some of the earlier tests, is corrosive but the sodium salt is nearly neutral. However, the solution should not come in contact with the skin, and equipment should be thoroughly flushed out after each use. Soil should not be treated in the root-feeding zone of trees, grapes, ornamental shrubs or other plants which you want to save. TCA is not supposed to be poisonous or inflammable but, as a safety measure, follow the directions given on the containers.

Some people consider TCA to be a little expensive for large scale Johnson grass control, its principal value being for smaller spot treatments or for applications to annual grasses where lower dosages are required.

In large quantities, TCA has been purchased for about 35 cents per pound, which brings the cost to $35 to $40 per acre. However, as was the case with 2,4-D, as the demand becomes greater and it is produced in larger quantities, the price may become lower. It is too soon to make price comparisons with other weed killers and TCA, but so far it is one of the most promising weed grass killers.

Testing of this chemical formulation is being continued because more information is needed before general recommendations can be given. However, if you have a grass problem that has thwarted other means of control and you believe that TCA may fit your conditions, it certainly warrants a trial.

THE END.

Million Dollars Saved on Anderson Ranch

Reclamation Commissioner Michael W. Straus recently announced that approximately $1,000,000 appropriated for work on Anderson Ranch Dam on the South Fork of the Boise River in Idaho has been returned to the Federal Treasury. This saving resulted from the Bureau's contracting for the required work at an amount of about $1,000,000 under the original estimate.

The estimated cost of the nearly completed dam, which will be the highest earth-fill structure in the world, has been reduced over a million and a half dollars in the past 18 months as a result of low bids. New designs and plans also resulted in a considerable savings on other work. The present estimated cost of the project is $30,714,000.

The dam, a unit of the Boise project, will provide hydroelectric power and irrigation water for the rich lands of the area. The first generator is expected to go into operation by January 1, 1951.

Report on the 19th Annual NRA Convention

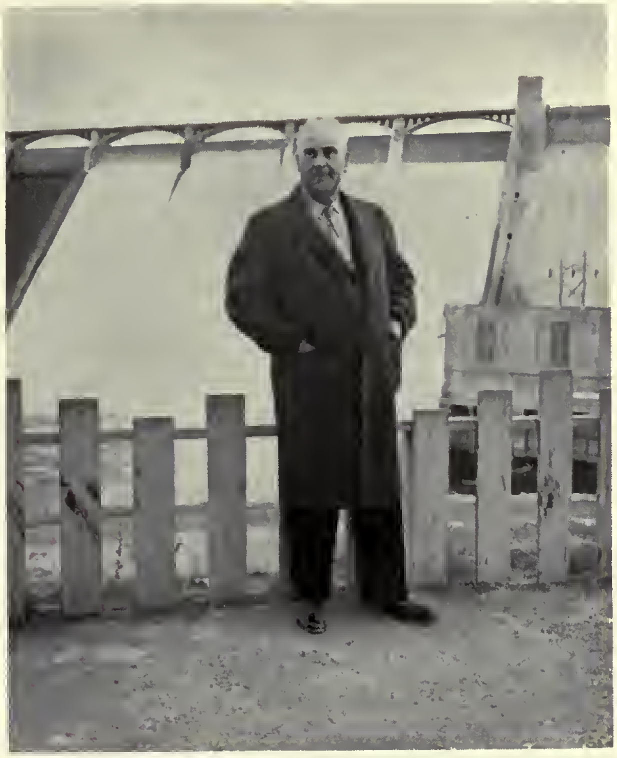
(Continued from page 1)

any excuse for basic conflict. Reclamation should support all these causes—in fact, it does. The multiple-purpose reservoirs and works almost uniformly serve the recreation, fish, and wildlife functions. But again the support and advance of these resources and their conservation should be by positive, not negative, action. Recreation and fish and wildlife development should be advanced and Reclamation should not be retarded. In the unique and rare, if noisy, cases where a real conflict of interest rather than an emotional eruption develops, the collision is—as it should be—disentangled on the basis of serving the greatest interest of the greatest number."

He also warned against the increasing encroachments proposed upon what he termed "the western water customs and code that you and your predecessors have erected into the Reclamation laws, that are irrigation's hard-won Magna Carta."

Citing cases of attempts to nullify Reclamation law, he said, "Reclamation is, I believe, the only Federal agency whose basic laws say that we must protect water rights and abide by State water-right laws. Reclamation strongly supports and adheres to this provision. Strange to say, there are some who are attempting to misuse the recent decision of the United States Supreme Court in the Gerlach California case in an effort to mislead the people into believing that Reclamation sought to deprive the people of their water rights. The best way to demonstrate conclusively that this is a complete and unmitigated falsification is to quote some of the language of the Supreme Court in its decision. Mr. Justice Jackson, giving the decision of the Court, said, "We are guided to this conclusion by the interpretation placed on Congress's acts by the Reclamation Bureau. . . . We are advised by the Government that at least throughout administration of California Reclamation projects it has been the consistent practice of the Bureau of Reclamation to respect such property rights." And in his concurring opinion, Mr. Justice Douglas, from this State of Washington, pointed out that this was the practice of the Bureau of Reclamation not only with respect to California projects but with respect to Reclamation projects generally in the 17 western States in which the Bureau operates. Justice Douglas said, and I quote:

> This Court has recognized, however, that administration of the act [by which Justice Douglas meant the Reclamation law] is to be in conformity to State laws.—Whatever doubts there may be are for me dispelled by the administrative practice under the act, as summarized by the Commissioner of Reclamation in a memorandum dated April 19, 1950. Reports from the seven regional counsel and a review of the files in the Bureau of Reclamation formed the basis for the memorandum. The Commissioner concluded that it has been the almost invariable practice of the Bureau to file notices of appropriations under State law without regard to whether the stream involved was navigable or nonnavigable. Such filings were made pursuant to State law on water rights riparian to at least 13 navigable or probably navigable rivers. . . . Moreover, the Commissioner of Reclamation has drawn our attention to recent public statements by Department of the Interior officers confirming this practice.



V. I. P.—Hon. John R. Murdock of Arizona, Chairman of the House Public Lands Committee, was one of the many important personages attending the N. R. A. Convention, which featured tours of Grand Coulee Dam (before which Senator Murdock is standing), the Columbia Basin project, and the Trentwood Aluminum Rolling Mill.

Commissioner Straus concluded by pointing out that the National Reclamation Association was established and exists primarily for the purpose of creating unity, saying "It is bound by its constitution and bylaws to support the Reclamation laws, philosophy, and program of the West," and urging the members to work for unification and agreement. THE END.

Central Valley's Flood Lesson

(Continued from page 13)

to Congress in November 1950, prepared long before the devastating flood, involves a plan designed to provide protection against repetition of the havoc wrought in the Pacific Coast State, along with its other multiple purposes. The legislation would authorize construction of eight additional reservoirs in the Central Valley project, all working together with the present water-control facilities, on the seven rivers which raged uncontrolled through the Valley and caused loss of life, destruction of homes, and crop and property damage running into millions of dollars.

The legislation sent to the Congress was designed to carry out the President's Folsom Formula under which all multiple-purpose reservoir projects are the responsibility of the Bureau of Reclamation, while facilities purely for the control of floods are the responsibility of the Army Corps of Engineers.

The bill would reauthorize the Central Valley project to include eight reservoirs, with a combined storage capacity of 3,465,000 acre-feet: Black Butte on Stoney Creek; Isabella on Kern River; New Hogan on Calaveras River; New Melones and Tulloch on Stanislaus River; Pine Flat on Kings River; Success on Tule River, and Terminus on Kaweah River. (See map on p. 12 and 13.)

Under the proposed legislation, the Central Valley project would include these eight reservoirs for the purpose of flood control, irrigation, and power. These reservoirs and the works associated with them would be coordinated and integrated physically and financially with the operation of the other features of the Central Valley project. The Bureau of Reclamation would construct, operate, and maintain the Black Butte, New Hogan, New Melones, and Tulloch Reservoirs and works associated therewith; construct and operate and maintain hydroelectric power plants at New Melones, Pine Flat, and Tulloch Reservoirs, and related transmission facilities; and operate and maintain the Isabella, Pine Flat, Success, and Terminus Reservoirs upon their completion by the Corps of Engineers.

Meanwhile, the Bureau of Reclamation continues its assignment to save and use wisely the waters of the West for the greatest benefit to the greatest number of people. The present Central Valley structures proved their worth during the November 1950 floods, and dramatically illustrated the gaps in California's water-control works. THE END.

The Story of Enders Dam

(Continued from page 16)

tion of Enders Dam was that of obtaining rock for riprap, and sand and aggregates for concrete. The contractors processed the most durable rock available in the area for the crushed rock gravel blanket, but were unable to find enough suitable rock in the area for the riprap, which was shipped in by rail from Guernsey, Wyo. The same situation occurred with regard to sand and aggregates. Most of the Republican River sand and gravel was not hard enough to meet Bureau standards nor did it have the mineral content which would assure a lasting, durable concrete. Some aggregates (one-fourth- to three-fourths-inch size) were supplied at a plant on the South Platte River near Ogallala, Nebr., and hauled 70 miles by truck to the dam site. The three-fourths- to 1½-inch size was mostly shipped from Golden, Colo., and Guernsey, Wyo. The contractor dry-batched the concrete at a separate batching plant and trucked it to one of two 34-cubic-foot capacity paving mixers.

The first concrete for Enders Dam was placed on September 2, 1947, in the invert of the circular conduit of the outlet works. The contractors concentrated on this structure so the river could be diverted through the outlet works and work on the dam cut-off trench could be completed.

Enders Dam was designed and constructed by the Bureau of Reclamation under the direction of L. N. McClellan, chief engineer. During the major part of the construction, U. V. Engstrom, construction engineer, was in charge, and the Wunderlich Contracting Co. performed the greater part of the construction work. Glaussen-Olson-Benner, Inc., completed the project, and C. O. Crane, formerly field engineer, continued the work as acting construction engineer.

Water is now rising behind Enders Dam, another testimony to the perseverence, cooperation, and ingenuity of the American people, and their faith in the future of the West. THE END.

Warne In Hawaii

William E. Warne, Assistant Secretary of the nterior, left for Hawaii on November 27 to parcipate in hearings to be held by Governor Ingram tainback for the purpose of determining water evelopment possibilities in the islands.

The program was made possible when Congress, ı approving the appropriation act this year, inluded a special provision instructing the Departnent of the Interior to explore the possibilities f Hawaiian water resource developments which ould be undertaken by the Bureau of Reclamaion, and specifically called for a report on this ubject to be made to the next Congress.

If the Department of the Interior is granted unds and authority to undertake the necessary vork in Hawaii, Reclamation experts will develop lans and build projects to harness and use for rrigation and other purposes power-development vater that is now being lost. •

Private Business Helps Government Save Irrigation Water

Private business concerns, donating time, quipment, and materials without cost to the Government, are working with the Bureau of Reclamation to reduce water-seepage losses in the rrigation canals of the West.

Besides furnishing products for laboratory tudy in the Bureau's Engineering Center at Dener, Colo., the companies are cooperating with the Government in field studies in eight Western States to develop a lower-cost lining for the litches which last year poured Federal Reclamaion water on more than 5,000,000 thirsty acres to provide crops valued at more than a half-billion lollars. Under present conditions, losses from seepage amount, in some instances, to a third or more of the water entering the canals.

While Bureau nuclear experts at Denver explore the use of "tagged atoms"—radioisotopes—to trace the course of seepage in irrigation canals (see Atomic Detectives, p. 153, August 1950 Reclamation Era) canal lining research has been principally in the fields of portland cement concrete, asphaltic concrete and membranes, and selected earth materials, Reclamation Commissioner Michael W. Straus reported to Secretary Chapman recently.

Among organizations and companies participating were the Portland Cement Association of Chicago; the Asphalt Institute of New York City; Madsen Iron Works of Huntington Park, Calif.; Barber-Green Co., of Aurora, Ill.; Hercules Powder Co., of Wilmington, Del.; Stanacal Asphalt Bitumuls Co., of San Francisco; the Presstite Engineering Co., of St. Louis; Kerr-McGee Oil Co., of Oklahoma City; Owens-Corning Fiberglas Corp. and Shell Oil Co., of San Francisco, Socony-Vacuum Co., of Kansas City; Union Oil Co., of Los Angeles; Husky Refining Co., of Cody, Wyo.; and the Lion Oil Co., of Eldorado, Ark.

Examples of outstanding contributions include the Portland Cement Association's sponsorship of the most elaborate of the Reclamation-private industry tests, the installation of a three-fourths mile of soils cement lining in a W. C. Austin project lateral. Through cooperation with Madsen Iron Works it arranged for the construction and use of a special subgrade guided slip-form for placing the cement. The Hercules Powder Co. supplied large quantities of commercial resin, Stabinol, and helped apply it in experimental stabilization of earth lining on the same project. •

L. R. Douglass Named Boulder Canyon Head

Louis R. Douglass, former assistant director of the Bureau of Reclamation's Region 3, with headquarters at Boulder City, Nev., is the new director of power of the Boulder Canyon project at Hoover Dam. The appointment was made by the Secretary on the recommendation of Regional Director E. A. Moritz.

Mr. Douglass succeeds Carlo P. Christensen, who died last June 15.

The change in positions moved Mr. Douglass from his regional office in the Bureau of Reclamation's administration building in Boulder City, Nev., to a project office across the hall. The regional and project headquarters are under the same roof.

Joining the staff of the chief engineer's office of the Bureau of Reclamation at Denver, Colo., in September 1933, with a background of more than 20 years of experience gained in the field of engineering in the Western States, Mr. Douglass has been with the Bureau of Reclamation for the past 17 years. His first assignment with the chief engineer's office was in the division of design of concrete and earth dams, and appurtenant structures. While there he was actively engaged in design of certain phases of the Hoover Dam, which was then under construction. •

WATER REPORT

During November, floods in California and Nevada increased off-season storage in several Reclamation reservoirs. On the Central Valley project in California about a quarter of a million acre-feet of water was caught and stored behind Shasta and Friant Dams. These waters will be available for irrigation and power in the parched valley when released next irrigation season. In Nevada, on the other side of the Sierras, floodwaters filled Boca Reservoir on the little Truckee River, and accounted for most of the 235,000 acre-feet rise in the reservoirs that serve the Newlands project. In the Pacific Northwest several projects report unusually wet weather for November and most reservoirs stand at above seasonal normal. While the flow of the Colorado River into Lake Mead has been reported below normal for several months, the reservoir still contains ample water for next season's needs.

The reservoirs of projects in the Great Basin generally stand at favorable levels. The Salt River and the Rio Grande projects continue to report water scarcities and heavy spring and winter precipitation is needed to improve their condition. Most of the reservoirs in the Missouri Basin were reported to have near normal inflow and to have a favorable seasonal storage.

By regions the situation is as follows:

Region 1, the northwest region—the irrigation water situation is favorable; the storage and the flow into the reservoirs of most projects are above seasonal normal. Above normal snow and rains were reported in several projects. While the flow into the reservoirs of the Vale project in Oregon was above normal during November, above normal yield from the watershed is required this spring and summer because the seasonal storage is lowest since the Agency Valley Dam was built.

Region 2, record breaking floods occurred on most of the streams draining the Sierra Nevada into the Central Valley of California, improving the San Joaquin Valley's water supply situation considerably. Flood flows materially increased Orland project storage, although they had little effect on storage in Klamath project's reservoirs. Shasta and Millerton Lakes in November reached record high levels. In addition to storing precious water for next year's crops, these two dams prevented serious flood damage below them.

Region 3, including Arizona, southern California and Nevada, and western New Mexico—the flow into the region's reservoirs has been below normal during the month. The reservoir behind Roosevelt Dam on the Salt River project is lowest in ten years and water continues to be scarce on the project. While the flow into Lake Mead has been below normal, there is ample storage to irrigate the crops in the lower Colorado River Valley.

Region 4, the intermountain region—storage in the reservoirs serving the Newlands project has increased 235,000 acre-feet during November, due mostly to floods occurring during the latter part of the month. Except for the Mancos project in Colorado, the remaining reservoirs stand at favorable seasonal levels. On the Mancos project the season has been very dry and very little snow is reported in the mountains.

Region 5, including New Mexico, Oklahoma, Texas, and southern Colorado—the irrigation season on the W. C. Austin project will close during the first part of December instead of its normal ending October 15. The summer season was the wettest of record followed by eleven weeks of drought. Most of the reservoirs of the region stand at a favorable seasonal level in spite of the below normal inflow during the last few months. The situation on the Rio Grande, where the Elephant Butte reservoir stored less water than any November since 1918, is reported critical. No stored water is being released for winter irrigation, and soil moisture is low.

Region 6, the upper Missouri Basin—melting snow has kept the flow into the reservoirs on the St. Mary and Milk Rivers above normal. The reservoir levels in the region generally are favorable and their inflows are near normal or above.

Region 7, the lower Missouri Basin, including the North Platte—a generally favorable outlook for irrigation needs next year. Closure was made of Cedar Bluff Dam on the Smoky Hill River in Kansas during November and storage in the reservoir commenced. ●

CROPS

Thirty-five hundred acres of wheat in Washington produced certified seed this year. Yields were 25 to 30 bushe[ls] an acre around Ritzville and had a[bout] about 60 bushels in more humid lo[ca]tions.

Apples of the 1949 crops shipped fr[om] the Yakima Valley totaled 11,673 c[ar]loads, compared with 10,039 the year [be]fore. The last old-crop Winesaps, [2] carloads sold on the New York mark[et] in July 1950; brought for 1 car, $7.21 p[er] box, and for the other, $7.03.

The Oregon production of fruits a[nd] berries in frozen pack during 19[49] amounted to 64,000,000 pounds. Froz[en] vegetables processed totaled 62,000,[000] pounds.

(Three items above reprinted fr[om] the October 1950 issue of The No[rth]west, publication of the Northern [Pa]cific Railroad.)

LETTERS

Interesting and Useful

Allahabad U. P., India,
April 29, 1950

Dear Editor: I have herewith [to] thank you for your kind courtesy [in] sending the Reclamation Era, wh[ich] I have been receiving since Novem[ber] 1949. I have read the articles w[ith] interest and have to say that the p[ub]lication though primarily intended f[or] giving information regarding activiti[es] of the Bureau of Reclamation to t[he] taxpayers in America, provides inte[r]esting and useful information to all e[n]gineers connected with reclamati[on] service in their countries elsewhere.

Yours faithfully,
Shri Yadava Mohan, I. S. E.,
Consulting Engineer,
Rihand Construction Circle.

Best of Twenty-Two

T. C. Butler, Jr., consulting engine[er] and associate, Continental Bank Bui[ld]ing, Boise, Idaho, recently append[ed] this welcome note to a letter aski[ng] for back copies of the Era:

"Let me express my approval of a[nd] appreciation for Reclamation Era; [one] of the very best magazines that reach[es] me out of a total of 22 periodicals.

"I believe it is doing a wonderful [job] of good for reclamation and theref[ore] for the American people who benefit [by] it to the last 100 percent of the pop[u]lation, east, west, north, and south."

Incidentally, we have a limited su[p]ply of back copies which we are gi[ving] end upon request. The single copy is 15 cents, with reduced rates quantity purchases as follows:

to 9 copies__________ 12 cents each.
to 50 copies_________ 10 cents each.
or more copies______ 8 cents each.

ake out check or money order to TREASURER OF THE UNITED TES, and send request to the Bu- of Reclamation, United States De- ment of the Interior, Washington D. C. Please do not send stamps. small orders, coins will be ac- d.

Service Through Simplicity

2420 RIDGE ROAD.
BERKELEY 9, CALIF.,
March 15, 1950.

EAR EDITOR: I am a graduate student rm economics now in attendance at University of California, and a lar subscriber to the RECLAMATION For the last year or two, at the est of a friend of mine who is now harge of the division of water util- on with the Israeli Department of culture, I have obtained for him on costs of water for irrigation in West and how to go about computing .

our article Measuring Well Water, I. R. McDonald, fills a long-felt need is field. It is clear and comprehen- to farmers without the benefit of llege course in calculus or the ability ompute lengthy formulas.

1) Could you, please, secure for me reprints of this article to be sent to division of water utilization in el and translated into Hebrew?

2) Have you any other published erial on simple devices for measur- water (in pamphlet form) or is the e article abridged from the differ- experiment station bulletins which quite comprehensive, but (on the le) too technical for the use of ners—as we were able to see in the ?

our cooperation will be much ap- iated.

Sincerely yours,

(Sgd) BEN PRAGER.

fter several years of crusading inst Government Gobbledygook, and cialized technical terminology, a let- like this makes us feel our battles inst verbal mumbo jumbo have not n in vain. Men and women working the job of transforming western deserts into blooming oases, and wilder- nesses into flourishing farmlands, have piled up an amazing amount of know- how—over a half century's worth. We believe this information should be shared with the people who use and pay for the water and electricity made available as a result of the Bureau's work. Most of the people in the recla- mation area are highly educated, but none of them can be expected to be specialists in every subject concerning reclamation, or be familiar with the technical terms which become working tools to the technicians. Therefore, our aim has been to translate helpful and useful technical information into popu- lar, easy-to-read and easy-to-understand vernacular. It is good to know that once in a while we succeed, and that the cooperation of our contributors and their help in popularizing reclamation science are appreciated.—Ed.

ERA Subscriber for 34 Years

P. O. Box 194,
BURLEY, IDAHO,
June 12, 1950.

DEAR EDITOR: Enclosed is a money order made out to the Treasurer of the United States in the amount of $5 in payment for 10 years' subscription of the RECLAMATION ERA, beginning with the January 1950 issue, if possible.

I have been a Bureau of Reclamation employee since April 24, 1916, and have always enjoyed the magazine.

If the rate of 50 cents per year will be changed to $1 per year, if and when I retire, the number of years covered by this subscription can be reduced ac- cordingly or I can then make an extra payment to cover the difference in amount paid now and what will be due until the end of the 10-year period.

Sincerely yours,

(Sgd.) MISS ANNA J. LARSON.

Is this a record? The ERA would be interested in hearing from other long- time subscribers who have kept in touch with Bureau of Reclamation ac- tivities through its official monthly publication.—Ed.

Correction

In the "Sand Trap Blues" article ap- pearing in the November 1950 issue of the ERA we located coauthor Milo W. Höisveen at Bend, Oreg., instead of at his correct headquarters, Ephrata, Wash. We regret this error.

RELEASES

Wyoming's Coal Resources

Coal reserves in Wyoming total 121 billion tons according to the Geological Survey which is conducting a survey of these reserves throughout the United States, and compiling their reports also as part of the Department of the Inte- rior's program for development of the Missouri River Basin.

For the sake of comparison, this re- serve shapes up favorably with those of Montana and North Dakota, while it exceeds that of Pennsylvania and is slightly less than that of West Virginia.

This total of 121 billion includes 13 billion tons of bituminous coal and 108 billion tons of subbituminous coal, which together equal or exceed 20 cubic miles of solid fuel. More than one- half of the "black gold" is used exten- sively for railroad fuel. Approxi- mately one-fourth of the supply is ex- ported to other States for industrial uses and retail sales. Some of it is shipped as far away as Minnesota and Washington.

This appraisal of Wyoming's coal reserve is being used to evaluate the energy resources of the Northwest. The finding is a result of extensive study and research of the Geological Survey files and material provided by coal min- ing and oil companies, along with nu- merous individuals in Wyoming.

For the complete story of Coal Re- sources in Wyoming, by Henry L. Berryhill, Jr., Donald M. Brown, An- drew Brown, and Dorothy A. Taylor, write to Geological Survey, Washing- ton 25, D. C., for free copies of the report. ●

Hoover Dam Movie Goes Abroad

A movie, with sound, of Hoover Dam, is now being circulated to foreign coun- tries under the auspices of the Inter- national Motion Pictures Division of the United States Department of State. This 42-minute film which is available in 16- and 35-millimeter rolls, includes some of the Bureau of Reclamation's footage on Hoover Dam, and was given a special production treatment for the State Department, which has also pre- pared a film guide which carries "stills" from the film, background information, and suggestions for using the film in foreign countries, where the audiences hold discussion programs following the movie show.

Quoted from the State Department brochure is this statement, "Of primary and obvious importance, the film is valuable as a picturization of one of the great engineering feats of modern times. The grandeur and scope of the project which made Hoover Dam possible are dramatically presented. In this respect, the film furnishes audiences abroad with a splendid example of America's ability to mobilize the forces of Nature, the skills of modern engineering, and the resources of the Nation to assist the people in controlling their own destiny." ●

Don't Overirrigate

Overirrigation wastes water and ca even be harmful to crops and soi Applying more water than a soil wi hold can cause deep percolation tha will leach out valuable plant foods, suc as nitrates, to a depth below the feed roots of plants.—(*From The Californi Farmer, p. 45, July 15. 1950, issue.*)

NOTES FOR CONTRACTORS

Contracts Awarded During November 1950

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contr amou
3146	Columbia Basin, Wash	Nov. 17	2 230,000/196,000-volt circuit breakers for Grand Coulee 230-kilovolt left switchyard, schedule 1.	Westinghouse Electric Corp., Denver, Colo.	$143,
3182	Missouri River Basin, Nebr	Nov. 15	1 lot of embedded gate anchorages for 3 42- by 30-foot radial gates at Trenton Dam.	Willamette Iron & Steel Co., Portland, Oreg.	22,
3186	Columbia Basin, Wash	Nov. 28	2 portable oil purifiers for Granc Coulee power plant.	De Laval Separator Co., Chicago, Ill.	14,
3193	Colorado-Big Thompson, Colo.	Nov. 7	Construction of 72 miles of Brighton-Hoyt-Brush 115-kilovolt transmission line.	Malcolm W. Larson, Denver, Colo.	516,
DS-3200	Columbia Basin, Wash	Nov. 14	Motor-control switchgear assembly and 1 spare circuit breaker removable element for Quincy pumping plant.	General Electric Co., Denver, Colo.	34,
DS-3201	Central Valley, Calif	do	3 travelling water screens for laterals 92.2W and 93.2E for Lindmore Irrigation district, Friant-Kern Canal distribution system.	Link-Belt Co., San Francisco, Calif.	23
DS-3202	Davis Dam, Ariz.-Nev	Nov. 22	1 100-ton travelling crane for machine and apparatus repair shops, system operations, and maintenance area.	Moffett Engineering Co., Albany, Calif.	49
DS-3205	Central Valley, Calif	Nov. 14	13 vertical-shaft, turbine-type pumping units for L3 and L4 pumping plants, laterals 93.2W, 93.2E, and 93.2E-0.1S, Unit 3, Lindmore irrigation district, Friant-Kern Canal distribution system, schedule 1.	Food Machinery & Chemical Corp., Los Angeles, Calif.	16
DC-3206	Rio Grande, N. Mex	Nov. 27	Construction of 80 miles of Socorro Albuquerque 115-kilovolt transmission line, schedule 1.	Reynolds Electrical and Engineering Co., Inc., El Paso, Tex.	624,
DS-3220	Missouri River	Nov. 9	Fabricated structural steel for Boysen switchyard and Alcova-Boysen and Boysen-Thermopolis 115 kilovolt transmission line.	Union Steel Co., Los Angeles, Calif.	47
DS-3225	Missouri River Basin, N. Dak.	Nov. 30	6 potential transformers for Devils Lake aud Jamestown substations.	General Electric Co., Denver, Colo.	19,
R3-PX-55	Davis Dam, Ariz.-Nev	Nov. 1	Switchyard control and relay board for Phoenix substation	General Electric Co., Phoenix, Ariz.	15,
R3-B-21	Boulder Canyon, Ariz.-Calif.-Nev.	Nov. 8	Air-conditioning system for the municipal building at Boulder City.	Valley Sheet Metal Co., Phoenix, Ariz.	21,
R3-PX-44	Davis Dam, Ariz.-Nev	Nov. 10	Deep-well pumps and piping for Mesa, Coolidge, and Tucson substations and System O&M area.	Thomson Plumbing & Heating Co., Phoenix, Ariz.	58,
R6-Bll-8	Buffalo Rapids, Mont	Nov. 8	Construction of additional canal and waste-way structures	Long Construction Co., Billings, Mont.	31,
617C-20	Riverton, Wyo	Nov. 6	Asphaltic undersealing of approximately 2,400 lineal feet of concrete canal lining between stations 215+00 and 234+00 and stations 244+00 and 250+00, Wyoming Canal.	Studer Construction Co., Billings, Mont.	13,
R7-157	Missouri River Basin, Kans.	Nov. 22	Constructing residence and maintenance facilities building at Cedar Bluff Dam.	Hunter Construction Co., Hays, Kans.	24,

Construction and Material for Which Bids Will Be Requested By March 1951

Project	Description of work or material
Boise, Idaho	Excavation of East Hartley Gulch drain near Caldwell, Idaho.
Do	Surfacing roads at Anderson Ranch Dam.
Central Valley, Calif	780,000 cubic yards of excavation of river channel below Pacific Gas & Electric Co. dam and power plant; 118,000 cubic yards of excavation for penstocks; and 92,000 cubic yards of excavation for foundation of Folsom power plant, on American River near Folsom, Calif.
Do	Replacing 2 2-mile wood-pole sections of Shasta-Tracy 230-kilovolt transmission line with steel tower sections by erecting steel towers, restringing conductor, and stringing new ground wires.
Do	Construction of 48 miles of 12- to 54-inch diameter concrete pipe lines for the Southern San Joaquin municipal utility district on the Friant-Kern Canal distribution system near Delano, Calif.
Central Valley, Calif	Construction of 9 miles of 12- to 33-inch diameter inforced concrete pipe Lateral 74.6E for the Ex irrigation district on the Friant-Kern Canal tribution system near Exeter, Calif.
Do	Construction of 8.5 miles of 12- to 48-inch diame welded-steel pipe lines for Lindsay-Strathmore gation district on the Friant-Kern Canal distri tion system 2 miles east of Linsay, Calif.
Do	Resurfacing streets and constructing curbs, gutt and sidewalks at Shasta Dam government ca near Redding, Calif.
Colorado-Big Thompson	Construction of 370,000-cubic-yard earthfill Wil Creek Dam for diversion of Willow Creek wate Granby Reservoir; construction of 2.5 miles of to 24-foot wide access road; and construction of miles of 13.8-kilovolt, wood-pole transmission l

Construction and Material for Which Bids will be Requested by March 1951 (cont'd.)

Project	Description of work or material
[Colora]do-Big Thompson	Construction of 90-foot high, 285,000-cubic-yard earth-fill Rattlesnake Dam, 14 miles west of Loveland, Colo.
[D]o	Construction of a concrete diversion dam and 12.4 miles of North Poudre supply canal extending northeast from the Cache la Poudre River, 18 miles northwest of Fort Collins, Colo.
[D]o	Construction of 90,000-kilovolt-ampere Flatiron switchyard, afterbay dam, and Flatiron power plant and pumping plant building to house 2 35,000-kilovolt-ampere generators and 1 370-cubic-foot-per-second capacity, 240-foot head, centrifugal pump, on South Cottonwood Creek 9 miles west of Loveland, Colo.
[D]o	Construction of Flatiron section of Horsetooth feeder canal, including 1.5 miles of concrete-lined canal, a 700-foot tunnel, and 2 500-foot siphons, 10 miles west of Loveland, Colo.
[D]o	Construction of 56 miles of Poncha Springs-Gunnison wood-pole 115-kilovolt transmission line.
[D]o	Construction of 36 miles of Flatiron-Fort Collins-Cheyenne Tap 115-kilovolt transmission line.
[D]o	Dispatcher's board for Flatiron dispatcher's building.
[Colum]bia Basin, Wash.	Construction of 91 miles of laterals ranging from 2 to 300 cubic feet per second capacity to irrigate 20,065 acres in lateral area E-3 on East Low canal 8 miles southeast of Moses Lake, Wash.
[D]o	Installation of complete heating and ventilating system in units R-1 to R-9, Grand Coulee right power plant, and installation of supplemental and miscellaneous heating and ventilating system in units L-1 to L-9, left service bay and left control bay, Grand Coulee left power plant.
[Davis] Dam, Ariz.-Nev	Constructing foundations and erecting a 12.5-kilovolt steel structure for Coolidge substation near Coolidge, Ariz.
[D]o	Construction of a fire station at system operation and maintenance area near Phoenix, Ariz.
[D]o	Completion of architectural finish work and miscellaneous installations of equipment in Davis Dam power plant, forebay and spillway structures.
[Desch]utes, Oreg	Placing pneumatically applied mortar canal sealing on North Unit Main canal near Bend, Oreg.
[Fort] Peck, Mont	Construction of 14 miles of 69-kilovolt wood-pole transmission line between Fort Peck and Glasgow Bench, Mont.
[Hung]ry Horse, Mont	Completion of 285,000-kilowatt Hungry Horse power plant at Hungry Horse Dam.
[Kend]rick, Wyo	Construction of 40 miles of 34.5-kilovolt transmission line between Seminoe and Bairoil, Wyo.
Kendrick, Wyo	Placing buried asphalt membrane lining of 1,700 feet of existing 600-cubic-feet-per-second capacity Casper canal.
Missouri River Basin, Nebr.	Construction of 11 miles of unlined and 2 miles of concrete-lined reaches of 685-cubic-feet-per-second capacity Courtland canal 4 miles southeast of Superior, Nebr.
Do	Construction of 14 miles of Courtland laterals to irrigate 3,464 acres.
Do	Three 42- by 30-foot radial gates for Trenton Dam.
Missouri River Basin, N. Dak.	Relocation of 2 miles of county road and raising of a county bridge near Dickinson Dam site.
Missouri River Basin, S. Dak.	Construction of 112 miles of 115-kilovolt transmission lines with overhead ground wires near Rapid City, Wasta, and Midland, S. Dak.
Do	Construction of 75 miles of 115-kilovolt transmission lines between Fort Randall, Gregory, and Winner, S. Dak.
Do	Construction of a 30-mile reach of concrete- and asphalt membrane-lined Angostura canal, and lateral and drainage systems, about 10 miles southeast of Hot Springs, S. Dak.
Missouri River Basin, Wyo.	Construction of 6,000-kilovolt-ampere Sinclair substation.
Do	Installing power plant equipment at Boysen power plant, 21 miles south of Thermopolis, Wyo.
Do	Relocation of 4 miles of county road at Keyhole Dam site 15 miles northeast of Moorcroft, Wyo.
Do	Relocation of 6 miles of U. S. Highway No. 14 at Keyhole Dam site and construction of a 3-span bridge 15 miles northeast of Moorcroft, Wyo.
Do	Installation of 2.5 miles of remote control cable between Seminoe and Kortes power plants.
Paonia, Colo	Construction of 3.3-mile extension of Fire Mountain Canal near Paonia, Colo.
Do	Reconstructing and enlarging 3.4-mile Overland Canal to an initial capacity of 140 cubic feet per second, near Paonia, Colo.
Rio Grande, N. Mex	Construction of 15,000-kilovolt-ampere Albuquerque substation.
Do	Construction of 52 miles of 115-kilovolt, wood-pole transmission line between Belen and Willard, N. Mex.
Do	1 control board, 1 125-volt battery charger, and 1 240/120-volt power distribution cabinet for Albuquerque substation.
Riverton, Wyo	Placing asphalt lining on 17 miles of 565-cubic-feet-per-second Wyoming Canal.

United States Department of the Interior
Oscar L. Chapman, Secretary
BUREAU OF RECLAMATION OFFICES

Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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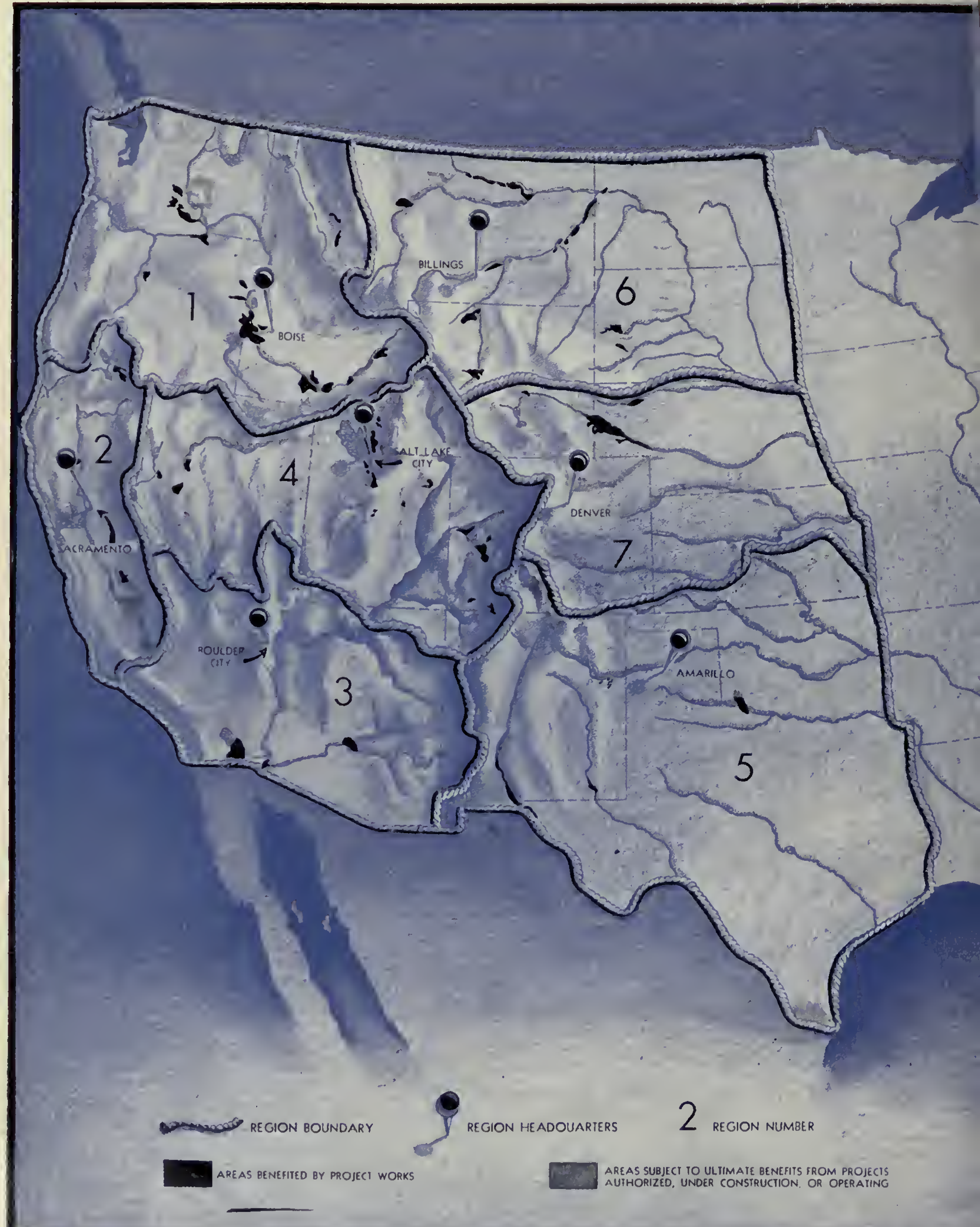

THE RECLAMATION AREA

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CONTENTS

FEATURE ARTICLES

SHORT FEATURES

OUR FRONT COVER

FROZEN FALLS

THREE MEN ON HUNGRY HORSE work through subzero temperatures, drilling inspection holes 3 feet in diameter in the bedrock foundation for the dam. This photo, taken on December 12, 1949, by A. E. McCloud, shows (from left to right) Dick Kangas, Roddy Popovich, and Atni Kangas working on the calyx drill rig set-up on the left abutment.

30 YEARS AGO IN THE ERA

Wrapping Apples in Oiled Paper Cuts Dow[n] Scald Loss

Wrapping apples in oiled paper has been found to pre[vent] apple scald, a cause of heavy loss during storage and tr[ans]portation. As a result of investigations by the Un[ited] States Department of Agriculture, a great many of the fa[ll] packed apples are likely to go out next year in oiled ins[tead] of plain wrappers. . . . A good quality of oiled wrapper [can] be prepared by hand, but the cost of labor is too great. [The] oiled paper on the market in 1920 had been prepared [for] other purposes and was too heavy for convenient use, [but] manufacturers are now preparing lighter weight oiled pa[per] for the 1921 crop.

(From p. 60, February 1921 issue of the RECLAMAT[ION] RECORD, predecessor to the RECLAMATION ERA.)

RECLAMATION PLACE NAMES IN THIS ISSUE

BLAST THE SILT

y S. T. LARSEN, O&M Liaison Officer, Branch of Design and Construction, Denver, Colo.

SILT'S LOADED by maintenance man Hoshaw, above. At right, Silt Away! Below, same pool less silt. *Photos by Karl Powers, Riverton project.*

HAVE YOU EVER had to clean silt from a small oncrete weir pool? Perhaps you have used a orse-drawn slip scraper, a hand shovel, or a ragline. No matter what method you use, you nust admit they leave much to be desired.

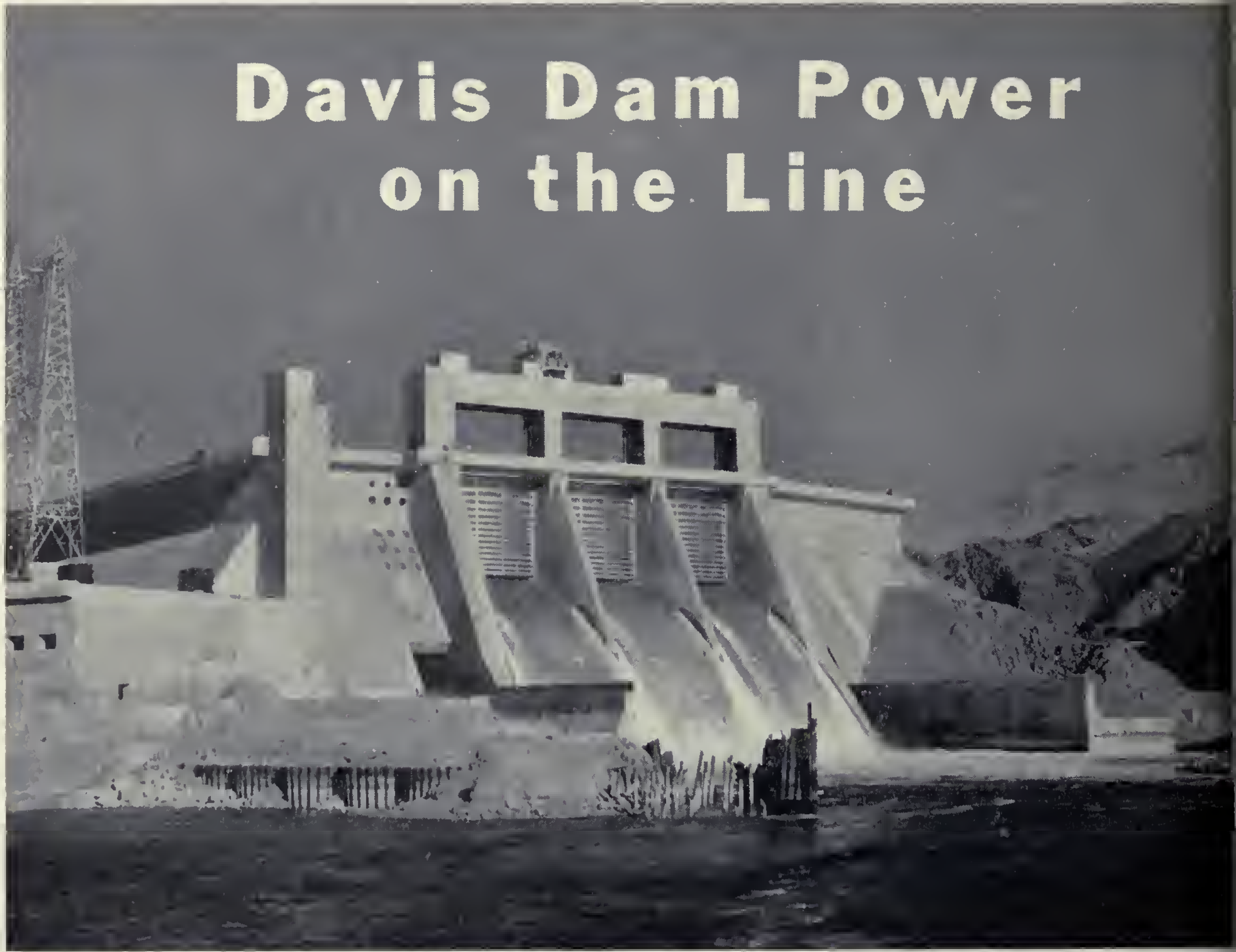
Except for hand shoveling, which is downight laborious, there is the expense and trouble nvolved in getting equipment out to the weir. Nowadays, mounting labor costs add to the probem of keeping small weir pools in good operating ondition, at a reasonable outlay of cash.

Operation and Maintenance forces on the Rivrton project in Wyoming think the answer to he problem is dynamite! People have been using dynamite to blast wet and mucky material out of drain channels for many years—why not pply that method to cleaning weir pools? In nswering that question, the O&M group sacriiced a few structures during the experimentaion period, but now believe the process is as safe nd sound as any dynamiting technique. It vould be wise, however, to follow the instructions arefully, keeping in mind the fact that the Rivrton forces blasted some weirs out of business luring the testing period.

If the pool is dry, saturate it first. This will nake it possible for the shock to progress from one stick of dynamite to the next, as the water ssures a pressure wave throughout the area which serves as a detonator. Saturating the pool will also make it easier for you to poke holes in the silt for the dynamite sticks. Use a wooden stick about 4 feet long and 1½ inches in diameter and locate the holes, each 18 inches deep, along the center line of the weir pool. The first hole should be about 5 feet upstream from the weir blade, the others extending upstream to the upper end of the pool spaced about 16 to 18 inches apart. Use ditching dynamite of 50 percent strength. Place a half-pound stick of dynamite in each hole and press it to the bottom of the hole by using the wooden stick. Save a hole in about the middle of the line for the priming charge. After you have filled all the other holes with dynamite sticks, set the "primer" stick last, with the waterproof fuse and cap, or electric detonator, in place. Light the fuse, or plunge the detonator, and watch the charge explode, throwing the silt out of the pool and scattering it where it will no longer be

(Please turn to page 41)

Davis Dam Power on the Line



Power from the Bureau of Reclamation's fourth largest source, Davis Dam and power plant, located 34 miles west of Kingman, Ariz., on the Colorado River between Arizona and Nevada, is now on the line.

During the first part of January, the first of five 45,000 kilowatt capacity generators in the Davis Dam power plant at Pyramid Canyon started turning. The schedule calls for one generator to go in production each month until the plant is completed, but it is expected that this schedule may be bettered. The estimated output of all generators is expected to be approximately a billion kilowatt-hours of energy per year.

Power produced at Davis Dam this year will be in time to aid the irrigation farmers in the Southwest who in the past have suffered crop losses because of insufficient power for pumping. Acute shortages of power for this purpose were experienced in the Salt and Gila River Valleys of Arizona, southeast of the project.

Davis Dam, the last of the large Reclamatio dams to be built below Hoover Dam in the presently planned development of the Colorado River uses the last major power drop in this section of the river. It is the last step in the stairway of river dams on the lower Colorado stretching from Laguna Dam, 13 miles northeast of Yuma Ariz., to Hoover, over 300 miles upstream. Other structures include Parker and Imperial Dams and the great All-American Canal. An undeveloped low power drop still exists at Pilot Knob, which will be utilized when surplus water from the All-American Canal is used.

With the beginning of power generation the project will be fulfilling the multiple purposes fo which it was built, namely (1) to service treaty provisions pertaining to the division of Colorad River waters between the United States and Mexico; (2) to produce needed hydroelectric power and (3) to reregulate irregular water releases from Lake Mead through the Hoover power plant fo

CHAPMAN STARTS FIRST DAVIS GENERATOR

On January 5, 1951, at his Office in the Interior Department, Secretary of the Interior Oscar L. Chapman pressed a telegrapher's key and put into commercial operation the first big generator at Davis Dam.

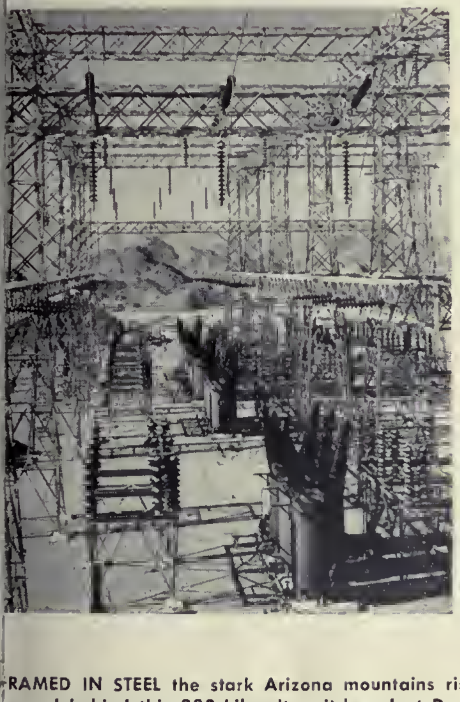
His signal, spanning a 2,700-mile remote control Western Union hookup to start the generator, was witnessed by congressional delegations from Arizona, California, and Nevada. The key, a special gold-plated instrument, was borrowed from the White House for the occasion.

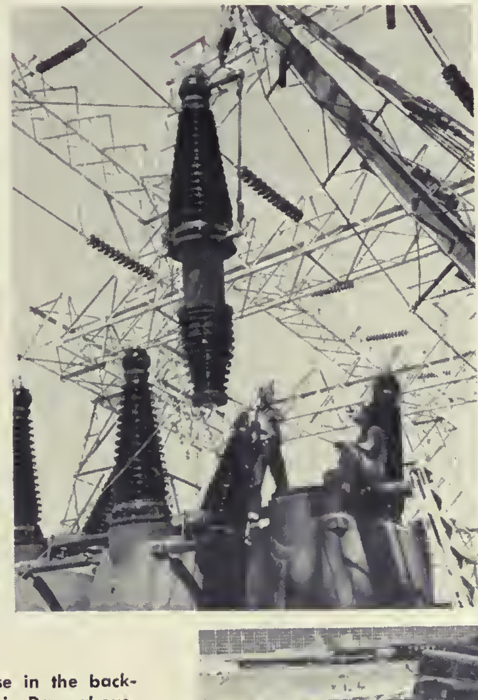
The official start of the generator was preceded by a message sent over the same wire from Secretary Chapman which stated in part, "I am happy to extend greetings to the people of the Pacific Southwest on this important occasion . . . The Lower Colorado River development is a shining example of what a free democracy can accomplish in utilizing the national resources for the benefit of its people. It is particularly pleasing that this major link of the development is going into operation in time for the power to be used as the Nation girds itself for freedom from aggression."

he benefit of farms in this country and Mexico.

The treaty with Mexico required that a dam be uilt in order to distribute a regulated delivery of ,500,000 acre-feet of water annually apportioned o that country under terms of the treaty.

However, the story of the development of the vhole Colorado River does not end with the comletion of this dam. There are many other choice pots on the main stem and branches of the river *bove* Hoover where other dams could be built—otably in Bridge, Glen, and Marble Canyons. Such dams could further regulate and conserve the river's water and energy, and their power plants could double the present output of hydroelectric energy on the lower Colorado. (For background information on Davis Dam, see previous issues of the RECLAMATION ERA for articles, How To Sidetrack a River, June 1946; Camp Life at Davis Dam, September 1946; Careers in Stone, July 1947; Detour at Davis, June 1948; Arthur Powell Davis, February 1950; and New Lake in the Desert, April 1950.) THE END.





RAMED IN STEEL the stark Arizona mountains rise in the background behind this 230-kilovolt switchyard at Davis Dam above. Above right: Close-up of crane using special sling to transport bushing for oil circuit breaker. The last lap (at right) truck and railer en route to Davis Dam to deliver 92-ton, 45,000 kilovolt ampere main power transformer for first generator. ***All photos for this article by Phil Blew, Region 3 photographer.***

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ONE MILLION cubic yards of concrete had been poured at Hungry Horse Dam, Mont., after Mel Hord (left) of the contractor's staff, and Jake Niemen, Bureau engineer, tripped the safety latches on this bucket. *Photo by A. E. McCloud, Region 1.*

Hungry Horse's First Million

Meeting the challenge of a tight construction schedule, construction crews at Hungry Horse Dam in northwestern Montana won their race against time and the elements with placement of the millionth cubic yard of concrete at 4:30 p. m., November 7, 1950.

The race to meet the 1950 construction goal at the big multiple-purpose dam and power plant being constructed by the Bureau of Reclamation on the south fork of the Flathead River ended in practically a photo-finish with old man winter. On November 8, just a day after the millionth cubic yard of concrete was placed, winter's paralyzing cold halted major concrete operations for the year.

But with achievement of the year's objective in sight, the concrete crews wound up the construction season in a blaze of glory. Continuing their work at top speed through the brief ceremony held in observance of the important milestone in Hungry Horse construction, the crews set a new 24-hour record of 7,172 cubic yards during the period from 8 a. m., November 7, to 8 a. m., November 8.

Gathered for the ceremonies, a small group o[f] Flathead Valley civic officials stood on the we[t] concrete of the dam and watched the bucket con[-] taining the millionth cubic yard of concrete swin[g] out from the mixing plant high on the canyo[n] wall and drop swiftly toward the blocks of th[e] dam shrouded in the gathering shadows. Man[y] of those present were representatives of civic or[-] ganizations that had worked and fought to secur[e] authorization of the Hungry Horse project.

The November 7 celebration was a happy cli[-] max to a driving finish in the 1950 constructio[n] race. Off to a slow start last spring, with crew[s] using jackhammers to chip foot-thick ice fro[m] the blocks of the dam, the job gradually gaine[d] speed, and progressed at a driving pace throug[h] the summer.

On October 1, there were 788,000 yards of co[n-] crete in place, and some of the smart money sai[d] the boys could not make the million-cubic-yar[d] goal before mid-November at the best. And th[e] forecasters predicted that old-man winter woul[d] throw an ice and snow barrier across the trac[k] and stop the race before the finish.

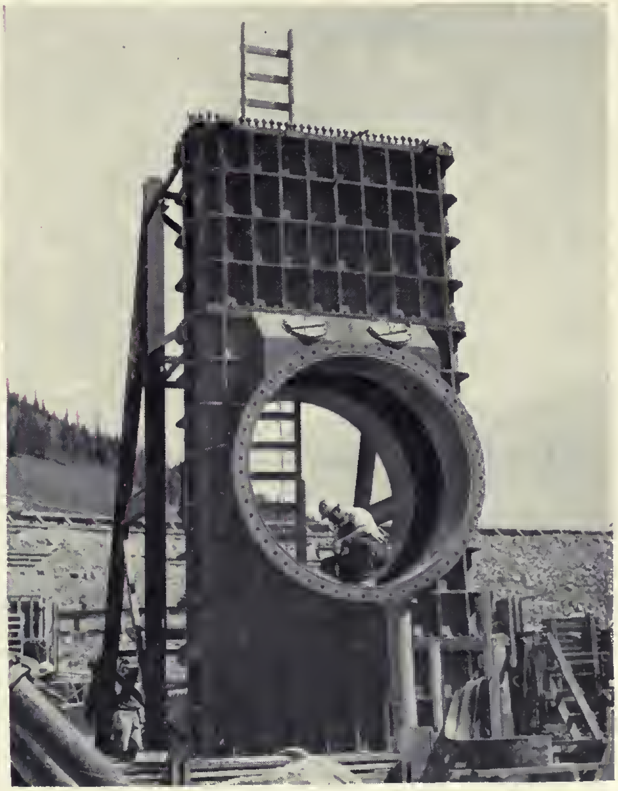
But the concrete crews put on a rousing stretch rive to break all monthly placement records with n October total of 184,000 cubic yards to boost he total concrete in place on November 1 to 72,000 cubic yards.

Continuing the fast pace during the first week f November, the construction crews passed the nillion-yard mark at 4:30 p. m., November 7.

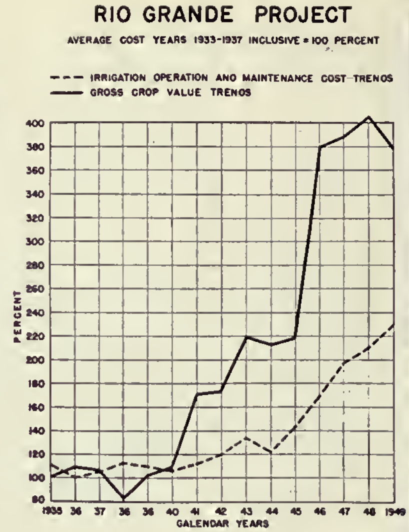
Because of its importance as one of the major power and flood control projects in the Bureau of Reclamation's region-wide program for multiple-purpose development of water resources in the Columbia River Basin, Hungry Horse Dam has been given a top construction priority. With the 1950 program accomplished, engineers for the Bureau and General-Shea-Morrison, prime contractor for the dam and power plant, are already laying plans for an even tighter construction schedule in 1951. Major work scheduled for 1951 includes placement of an additional 1,200,000 cubic yards of concrete and start of installation of the first two 105,000 horsepower turbines.

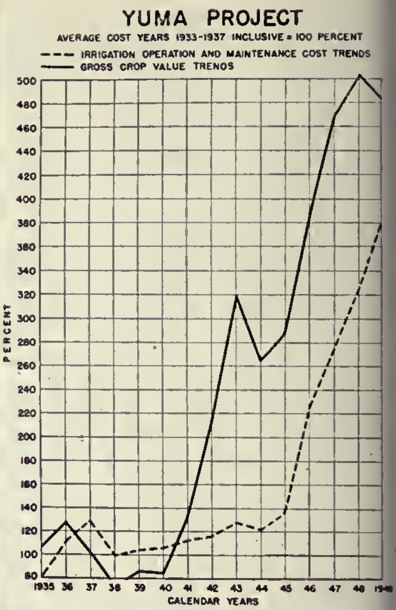
Under the present construction schedule, 1,000,000 acre-feet of water will be stored behind Hungry Horse Dam during the 1952 spring run-off. With the first two generators scheduled to go on the line in October and December of that year, this storage will make it possible for the Hungry Horse power plant to turn out approximately 90,000 kilowatts of power to help alleviate power shortage conditions in the Pacific Northwest during the 1952–53 winter peak load period. This storage also will firm up power output during the winter peak at downstream plants in Montana and on the Columbia River. THE END.

FERRIS-WHEEL form, man-made "geysers," and follower gates. ***Photos by A. E. McCloud and A. G. Rainwater, of Region 1.***



TWO TYPICAL Reclamation projects where operation and maintenance costs are way below the increased crop values, despite rising costs in practically every other item such as transportation, machinery, supplies, equipment, and labor.





O & M COSTS

"It's not the initial cost, it's the upkeep!"

How many times have you heard those words spoken? If you had been at the annual Operation and Maintenance Conference at El Paso, Tex., during the week of December 4–9, 1950, you would have heard references to the second topic frequently, although instead of upkeep the word most often used was O & M which of course means operation and maintenance to those familiar with the Bureau of Reclamation's vernacular.

Very few people took part in the conference this year, in order to save expenses. Less than two dozen carefully selected men, each a specialist in his own field, attended. In conformance with Commissioner of Reclamation Michael W. Straus' views, the hand-picked group concentrated on specific means for improving the work of the Bureau, with the accent on economical project operations and reimbursing the Government for the costs of irrigation construction. Never dur ing the conference, therefore, could you hav heard the first part of the quotation above. "It' not the initial cost." Nowadays the initial cost i a matter of grave concern, involving rising con struction charges, labor and materials shortages expensive delays, and many other problems.

However, the "upkeep" topic was foremost i discussions. The first thing, of course, was t determine how much O & M costs had risen. Yo may or may not be surprised to learn that in th last 8 years, irrigation farmers on Bureau project have been getting high-quality service on bot Bureau and water-user operated Reclamation proj ects at prices that have risen less than the price of many other services. Generally O & M cost have risen less than construction costs, and hav not risen along with crop prices, O & M increase

SERVICE IS THE WATCHWORD—The "before and after" pictures below illustrate one of the Bureau's functions on the Yuma project. Cleaning ditches is an important upkeep item, and on more and more projects the Bureau is saving money for the wate users by using chemicals to accomplish this purpose rather tha the mechanical method shown. *Photos by S. B. Watkins, Region 3*

aving been substantially less than those in crop alues. Although water charges are now taking roportionally less of the water user's dollar, the onferees recognized there is room for improvement and increased efficiency in many project operations, particularly in view of the uncertain nternational situation. Extended périods of national emergency have always demanded increased rop production in the face of rising production osts. Unfortunately for the older Bureau projects, rehabilitation and betterment programs are nly making a dent in the need for making up he set-backs of the last war and the preceding epression.

During the conference, the 20 men emphasized igh standards of service and maintenance to get he most out of every dollar spent. On operating rojects, particularly those operated by the Bureau, there are many items of costs which are eyond the Bureau's control. Higher wage and alary rates, the 40-hour week (a particularly exatious problem when considering gatetenders, itchriders, watermasters and project managers) nd portal-to-portal working hours, necessarily ncrease expenditures for labor and supervision. Iigher costs of supplies and equipment similarly re a major uncontrollable factor. In both categories, the diligence and resourcefulness of operating personnel are put to test. With generally rising osts for labor, materials, and equipment, increased fficiency and productivity per man-hour and per nachine-hour are needed to avoid an excessive ise in water charges.

One of the most troublesome items is the cost of "overhead"—administrative and facilitating services. Although rarely a major factor in rising O&M costs, the conferees recognized that it is particularly objectionable to water users because in some cases administrative costs have risen more rapidly than the other items of project costs. Some of these costs, also, are not within the control of the Bureau, and those attending the O&M conference went over all Federal administrative requirements, both those established by the Bureau of Reclamation and those imposed by higher authorities such as the Congress, the Bureau of the Budget, General Accounting Office, and the Civil Service Commission. All of these requirements, to greater or lesser degree, increase O&M costs without comparable increase in service to the water users. Some, but not all, of these requirements are lifted when water users assume project operation and maintenance. The conference developed recommendations to accelerate such transfers in order to lift the burden of these administrative and facilitative requirements from the shoulders of the water users. This would give the water users control of water service and maintenance work on their own projects.

The excellent record of the water users in negotiating amendatory repayment contracts helped pave the way for a number of recommendations at the conference to secure appropriate financial participation by water users on new projects. These recommendations were directed toward

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"THE MAN ON THE LAND . . ."

The following editorial appeared in the Yakima Wash., Sunday Herald, November 19, 1950. We are reprinting it here as a matter of interest to our readers.

We find it difficult to settle on a theme for comment upon the National Reclamation Association's convention, which comes to a close this week end in Spokane. The organization seems to be riddled with disagreements and controversies as to what its members think about beneficial, future reclamation policy. Or perhaps one might say that the NRA is going through a wholesome phase of adjustment out of which new and more progressive courses of action will emerge. That is the way political parties usually pass off their civil wars. . . .

There is, however, one aspect to the controversies over reclamation which we regret, and which we think is unnecessary: It is the implied discord between the farmers and the construction and operating personnel of the United States Bureau of Reclamation. We say no ill feeling exists between the man on the land and the resident, district, or regional bureau employees. They have, for many years, enjoyed pleasant relationships. And we would make the further observation that the average water user on the great Yakima project—which is one of the largest in the world—has no serious complaint against existing reclamation policies, either on ownership of basic facilities, or on construction or on operation and maintenance. If conditions of violent discontent and resentment exist between the farmers and the Bureau of Reclamation in this great area of proven projects, we are not aware of them . . . ●

ALL EYES ON WIND RIVER

Part One—PLANNING THE PILOT STUDY

Prepared with the cooperation of W. G. SLOAN, chairman of the Interior Missouri Basin Field Committee, and based upon material submitted by R. D. NIELSON, Bureau of Land Management, chairman of the subcommittee on Wind River Investigations.

"ACTIONS SPEAK LOUDER THAN WORDS."

In accordance with this old adage, within a river basin in Wyoming, people are preparing a resounding reply to the question, "How can local, State, and Federal agencies work together in developing a river basin's resources with a minimum of fuss and feathers and to the maximum advantage of the people in the area?"

It all began in November 1947. W. G. Sloan, chairman of the Interior Missouri Basin Field Committee, had called a meeting at Riverton, Wyo. He pointed out the critical silt and erosion situation within Wyoming's Wind River Basin. Irrigation at the Bureau of Reclamation's Riverton project, and the Wind River Indian Reservation had not helped the situation any. In fact, irrigation was partly blamed for the increase in erosion and siltation. In addition, the Bureau of Reclamation had started to build Boysen Dam

BUILDING BOYSEN—An important key to the development of the Wind River Basin. *Photo by T. R. Broderick, Region 6.*

and the engineers were much concerned about its future "take" in silt; 260,000 acre-feet had been provided for silt accumulation space. The Big Horn River is an energetic silt carrier, but actual data to judge the adequacy of this storage reserve was not available. The silt situation was reportedly getting worse instead of better. So was erosion.

During the discussions, Chairman Sloan pointed out that 90 percent of the Wind River Basin's area was under the jurisdiction of the Federal Government. Federal agencies had been working together effectively for several years on the wide-scale development of the 10-State (Colorado, Iowa, Kansas, Minnesota, Missouri, Mon-

RAMPAGING RIVER creates scenes like Five Mile Creek area shown at left. **REMEDIAL MEANS**—Artist's conception of Boysen Dam and power plant above by M. H. Willson.

tana, Nebraska, North Dakota, South Dakota, and Wyoming) Missouri Basin program and had devised many methods of pooling "know-how," equipment, and personnel to good advantage. The problems cropping up in the Wind River Basin are not peculiar to that region alone. Here was a made-to-order opportunity to demonstrate how all the people and agencies concerned could solve these problems: putting water on land where it would do the most good; keeping it from damaging the soil; protecting fish and game, livestock, and forests; developing mineral resources, and encouraging community and industrial development. Wholehearted cooperation would be certain over 90 percent of the area, at least. So the Wind River Basin was selected as the "proving ground" or, as it came to be called, a "pilot study" to point the way toward successful river basin development. According to Webster, a pilot is "a guide, a director or leader of another or others, through a difficult or unknown course." And that is exactly what the Wind River investigations prove to be.

The Wind River Basin, with an area of about 5,000,000 acres (8,000 square miles) represents approximately 1½ percent of the Missouri River Basin's total area of 338,560,000 acres or 529,000 square miles. Besides standing as a miniature model of what can happen to a river basin under intensive coordinated development, the Wind River pilot study will furnish valuable "do's" and "don'ts" for the people who will face similar problems in the entire Missouri River Basin and other areas.

SPILLWAY SHAPES UP—Construction progress shown on Boysen Dam spillway at left. BIG GUNS—The compacting and earth hauling equipment at right is stepping up the eventual water supply for 20,000 acres of land. ***Photos by T. R. Broderick.***

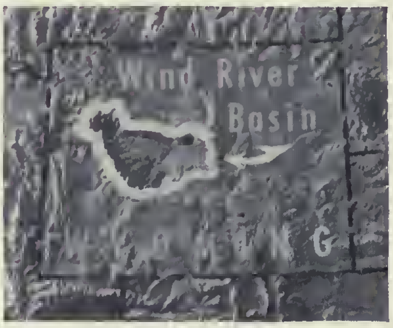
The first job was to get a general idea of the area as a whole, figure out what had to be done first, and find people who would do it. Three months after the Wind River investigations were suggested, the subcommittee which drew the assignment for the preliminary study presented an outline to the Field Committee at its monthly meeting at Lincoln, Nebr. This was approved and on April 20, 1948, the chairman of the subcommittee, R. D. Nielson of the Bureau of Land Management, with Ralph H. Workinger of the Bureau of Reclamation, and J. D. Lamont, Bureau of Indian Affairs (the other members of the Wind River Basin subcommittee) submitted a report to the Interior Missouri Basin Field Committee at its regular meeting at Billings, Mont.

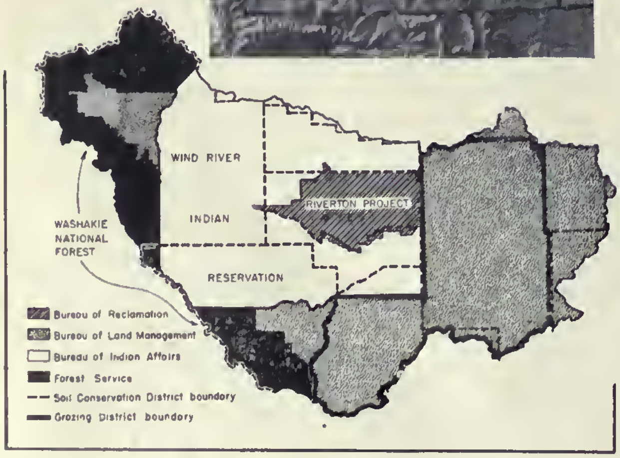
They had obtained a general description of the area, its resources and economy, an account of the resource development program in the Wind River Basin, a résumé of the interests of Interior Department agencies in the basin, with a summary of the work each agency was prepared to do, and had found out which agencies outside the Interior Department were interested and could participate in the pilot study. The subcommittee also had worked out a tentative time table of investigations needed to develop the Wind River's resources and solve the most critical problems.

Here is a summary of their general description of Wind River Basin.

THE BASIN TODAY

CLOSE-UP AND LONGSHOT of Wind River Basin in Old Wyoming. ***Prepared by Graphics Section, Washington, D. C., office of Bureau of Reclamation.***





The Wind River area is unique in many ways. It has a wide range of weather, soils, minerals, forests, fish and wildlife, water and land use problems, and agricultural, industrial, and recreational possibilities. It lies at the very headwaters of one of the principal drainages of the Missouri River. The Wind River becomes the Big Horn River a few miles above Boysen Reservoir where the Wind and Popo Agie rivers join, and beyond the Big Horn Basin joins the Yellowstone River on its way to the big Missouri.

Land ownership and control of the area is as follows:

	Acres
Indian reservation lands under the jurisdiction of the Bureau of Indian Affairs	2,018,000
Public domain under the jurisdiction of the Bureau of Land Management	1,344,000
National forest lands administered by the Department of Agriculture	830,000
Lands embraced within Reclamation withdrawal yet unpatented	160,000
State-owned lands	210,000
Privately owned lands	500,000
Total	5,062,000

NOW, AND WHAT COULD BE—The two maps at left show the present status of the Wind River Basin, while the one below shows the changes which can be made. Note at present the severe erosion trends and the limited and sparse vegetation in the area. However, with the cooperation of the various Federal agencies, irrigated acreages could be increased, wastelands could be reclaimed, seeded, and used for grazing, and a stepped-up all-out war on erosion would give the whole basin a face-lifting as shown below.

Illustrations for Wind River adapted from information supplied by the Bureau of Reclamation, Bureau of Land Management, Indian Service, and Forest Service.

POTENTIAL LAND USE

This patchwork-quilt-like division of the Wind River Basin under various ownerships is overlaid with soil conservation district boundaries, and grazing boundaries, in addition to various overlapping township and county areas, as well as tracts of land which are of definite concern to other Federal agencies and private interests.

The problem to be solved in the Wind River Basin is to use the land and water in such a way that it will provide the greatest benefit to the greatest number of people.

In 1940 there were 16,000 people living in the Wind River Basin, who depended on the soil and water resources for their livelihood. About 90 percent of the land in the basin is used for grazing. Farm crops and timber are the other principal sources of income, although petroleum resources are coming into the economic picture more and more.

Some of the grazing areas also support some timber and are significant as watersheds. According to livestock figures, there are about 190,000 sheep and 45,000 cattle which are primarily dependent on the basin as their principal pasture. Successful livestock production depends on both natural range and forage crops, as the climate limits the period during which the stock can be turned out to pasture. Farm crop production is practical only under irrigation. In 1947, crops from 9,913 acres of farm land within the Indian reservation were valued at $294,613. In the same year 38,600 acres of irrigated lands under the Riverton project produced crops valued at $2,360,849.

Coal is mined near Hudson, mostly for local use. Gas and oil are important industrially, and much crude oil and gas is piped and shipped to Casper for refining. In 1948 the Wind River Basin produced 12.9 billion cubic feet of gas and 9 million barrels of oil. Other minerals in the area include phosphate rock—a potentially important undeveloped resource—considerable gypsum deposits, and some asbestos, tungsten, mica, tantalite, and gold.

Lumbering is a significant industry of the area, railroad ties being the principal product. Power line poles are also produced in quantity, and there are a few small lumber mills in the Basin.

The Wind River Basin has some of the best fishing and hunting in the West. In the western portion of the basin, dude ranching is a flourishing business, and tourists provide a considerable income to the area. Outdoor sports include fishing, hunting, hiking, camping, and other recreational activities.

Wind River is served by two railroad lines and transcontinental highways.

This thumbnail sketch of the Wind River Basin may give you an idea of the interlocking pieces of the puzzle. Anything that is done to reclaim and irrigate arid lands will have an immediate repercussion on farm production, livestock raising, mining, lumbering, and vacationing. Similarly, when hydroelectric power is produced, farms, ranges, forests, mines, dude ranches, tourist spots, and industries will be affected.

Most of the water supply comes from the higher elevations in the national forest and the Wind River reservation. Management, protection and improvement of watershed areas here and elsewhere cannot help but have an effect upon other areas. Soil erosion, siltation, water yields, forage production, timber production, wildlife, and recreational uses must all be taken into account when planning a comprehensive development program.

Interior Department agencies participating in the plan include the Bureau of Reclamation, the Bureau of Indian Affairs, the Bureau of Land Management, the United States Geological Survey, the Fish and Wildlife Service, the National Park Service, and the Bureau of Mines. The United States Department of Agriculture's Forest Service, Soil Conservation Service, Production and Marketing Administration, and State Extension Service have important parts in the program, as do the Weather Bureau of the Department of Commerce and many State and local interests.

Priority numbers were given to designated items in the program. They were not hard-and-fast schedules, however, as everyone realized that a certain amount of juggling might be necessary as the pieces of the jigsaw puzzle began to fit together. Some programs might progress faster than anticipated, and unexpected delays would also require adjustment.

The Bureau of Land Management literally got in on the ground floor. The first thing that was needed was to take a complete inventory of the land and its surface resources.

Bureau of Land Management crews, composed of experienced land classifiers, men who know

(Please turn to page 40)

Taming the Tamarisk (Salt Cedar)

LT CEDAR silently begins to spread like a thief in the night, ove. At center, invading McMillian Reservoir, Carlsbad project. right, salt grass invading dead salt cedar. *All photos by ed S. Finch, Region 5.*

y JOHN H. KOOGLER and O. J. LOWRY, Con- ervationists (Public Lands), Region 5, headquarters t Amarillo Tex.

THEY ARE GANGING UP ON SALT CEDAR down here n the Southwest. By "they" we mean the Soil onservation Service, the Army's Corps of Engi- eers, and Interior Department's Fish and Wild- fe Service, Bureau of Indian Affairs, Bureau of and Management, and last, but not least of urse, the Bureau of Reclamation.

Why all this concentration on a beautiful, dec- rative shrub, often 15 feet tall, each full-grown lant faintly resembling a dozen closely packed hristmas trees? Before we answer this ques- ion, let us make it quite clear that we do not mean he tall evergreen cedar, widely planted in the outhwest as a shade tree whose proper name is he athol (tamarix aphylla), and never becomes a est, but the shrub species of the tamarisk, called alt cedar—not an evergreen, but deciduous— hedding its leaves in the fall, the most common pecies being tamarix gallica.

This latter shrub, a native of the Mediterranean egion, appeared rather mysteriously in the west- rn United States many decades ago, and within he last half century has invaded southwestern val- ey grasslands, river channels, floodways and reser- oir deltas with devastating effects. Ecologists scientists who make a particular study of plants nd their growing habits) have a surprisingly neager supply of information about the salt cedar nd how to control or destroy it. And destroyed it must be. Today salt cedar has completely taken over large areas on the Pecos River and the Rio Grande in New Mexico and the Red River in Oklahoma.

In 1940 the National Resources Planning Board estimated that the 14,000 acres (count them—14,000 acres) of salt cedar in the McMillan Reservoir Delta above the Carlsbad irrigation project in New Mexico consumed 54,000 acre-feet of water each year. At that rate, the salt cedar gobbles up almost half as much water as the Carlsbad project farmers use to irrigate their 25,000 acres of productive land.

Salt cedar grew so thick and fast in the McMillan Reservoir Delta that in 1948 project officials had to hack away at the shrubs and dig a channel almost 5 miles long through the salt cedar area so irrigation releases and low flood flows could find their way through to Lake McMillan.

On the 155,000-acre Rio Grande project in New Mexico and Texas, the farmers use about 730,000 acre-feet of water each year to irrigate their crops. Reclamation engineers believe that salt cedar in the river bed and on uncultivated areas above the Rio Grande project's storage reservoirs swallows 240,000 acre-feet of water each year, or more than one-third of all the water used annually for irrigation.

These are specific examples of the ravages of salt cedar and the damage it has done on Bureau projects. Other agencies have been gathering other incriminating data regarding this pest. Salt cedar takes over land which should be producing crops and pasture or furnishing food for wildlife. In the flat terrain typical of the Southwest, where the rivers meander along their un-charted courses, salt cedar becomes extremely dangerous at flood time. Dense growths of the pest can block the flood waters and spread them over the surrounding countryside; debris piles against the shrubs adding to the strength of the temporary blockade, and as a result roads, railroad tracks, towns, and ranches have been inundated—all because of the untamed tamarisk.

You can readily understand why there has been a surge of interest in this shrub, especially in view of recently aggravated water shortages throughout the United States, and the emphasis on soil and water conservation.

We in the Bureau of Reclamation started the Carlsbad Salt Cedar Control and Water Conservation project in 1948, and for obvious reasons selected McMillan Reservoir Delta as our outdoor laboratory. The studies were paid for out of soil and moisture, Carlsbad project, and general investigation funds.

First we tried an air-attack, spraying 200 acres of growing salt cedar from an airplane, using the then new hormone-type weed killer known as 2,4-D. Two weeks after the first treatment, we noticed the leaves were falling off the salt cedar. However, only a small percentage of the shrubs were actually killed.

The following June, we sprayed half of the original 200-acre test plot, spreading 2,4-D over the 100 acres from an airplane. This second application killed 85 percent of the salt cedar.

Between September 1948 and October 1950, we experimented with various mixtures and ran tests on 25 separate plots during the 2-year period. Our spray mixtures of sodium and amine salts of 2,4-D varied from 1,000 parts per million to 5,000 parts per million in 100 gallons of water. We obtained the most satisfactory results with two applications of 3,000 parts per million of 2,4-D in 100 gallons of water, spraying some plots from an airplane and others from a ground-spray rig. Both methods gave favorable results, airplane spraying having an advantage for areas where it is difficult to get ground-spray equipment to the site. We found airplane spraying to be the most practical way of killing salt cedar in stream beds or on ground that is being cleared for pasture, where dead brush does not have to be removed.

We contracted with a regular flying service for all of our airplane spraying, the Bureau furnishing the chemicals and the ground crew for mixing and loading. At present, we are unable to figure the costs of this operation as the short hops and special test sprays over small areas made the operation more expensive than it would have been for large-scale operations. However, the cost for spraying large areas of salt cedar should be about the same as for applying similar volumes of herbicide to field crops. Our airplane expenses ran about $6 an acre.

So far, we believe that salt cedar infested lands that are to be used for cultivated crops should be cleared with mechanical methods. Up to the present time, the cost of clearing and removing brush on the test plots have averaged $56 per acre.

Although the salt cedar control experiments are not scheduled to end until 1952, the information we have assembled since 1948 reveals the following facts:

1. Salt cedar can be killed with at least two sprayings of properly proportioned 2,4-D if applied to the foliage during the plant's growing season.
2. The cost of chemical control is less than the the cost of mechanical control.

We will not have final results on the program designed to solve the salt cedar problem and salvage irrigation water on the Carlsbad irrigation project until we have run tests through another two growing seasons. However, we are most encouraged with the results so for. Now that committees responsible for coordinating the development of river basins have formed salt cedar subcommittees, and other groups of agencies have banded together to help develop a comprehensive plan for salt cedar control, we believe we shall soon have the answer to the problem of halting the spreading growth of salt cedar, and taming the terrible tamarisk. THE END.

Chapman Issues Security Directive

Secretary of the Interior Oscar L. Chapman issued the following directive to the heads of all bureaus on December 21, 1950:

The President of the United States has proclaimed the existence of a national emergency. Pursuant thereto and implementing my memorandum of July 13 relative to protective measures to be taken in the event of an emergency, you are directed to take steps immediately to restrict access of the public except to authorized persons to those parts of the interiors of dams and power plants that are vulnerable to sabotage and to control access to all vital installations or parts thereof considered to be of critical importance to the security of the Nation. •

PLAIN TALK from KANSAS

A talk given at the City Hall, Stockton, Kans., before the Kansas Reclamation Association's annual meeting by Mrs. Curtis Fry, Webster, Kans., October 4th—10:30 a. m., 1950.

TRUE PIONEERS—Mr. and Mrs. Curtis Fry. *Photo by Ralph Williams, Region 7.*

I AM A DAUGHTER OF THIS SOLOMON VALLEY. My ather and mother took up a homestead near the outh of Lost Creek in 1877, and on April 1, 1878, ey brought by covered wagon their few belongngs and two small children and settled here.

This was home to them for the rest of their lifeme. They were honest, true, and sturdy pioeers who came to make a home in the wilderness nd to derive a livelihood from the untamed rairies.

You, friends, as well as I, have heard some nitwits" of today say, "Oh well, the Government ave them the land."

Folks, I can tell you what small part the Govrnment gave to the pioneer of yesterday. It was piece of paper, betting 160 acres of land that ou couldn't live and make a home on it for five ears. Many pioneers won that bet through toil, dversities, brain and brawn. Many pioneers ave that hard-won heritage to their loved ones own through the generations trusting in them to arry forth and develop God's plans for the benet of mankind.

Today we see those intentions of the Divine laster being fulfilled, as was wont to be. I think is safe to say there is no more worthy heritage an the Reclamation unit that today stands on olid footing. Its vast worth can never be measred in dollars and cents. It is a heritage that enefits humankind to the four corners of the arth, not just the United States alone, but to every uman being in the world.

Irrigation in rich valleys of soil and sunshine ill feed the teeming millions of other places less ortunate. It is up to man to carry out God's will nd intentions. Within the mind and human heart f man, He has placed the seed of desire, determination and effort to try hard to do so. On these grounds the Bureau of Reclamation has been founded, and in this spirit its endeavors are going forward with success.

Everything accomplished in this world is through effort, strife, and determination, and we find many worthwhile causes are thrown by the wayside through timidity, through pressure from groups, or from want of help—honest-to-goodness help. However, we begin to think of the pressure on High working through the elements of Nature, which wash our soil away to the far off sea by devastating floods, which sear by drought the sands of rivers, ponds, and creeks of water making them fit for neither man, nor beast, nor bird. How the thoughts flew to my mind of the great place close by, and other places too, that nature had so made and helped to win half the battle, and then cried out to man for help.

When we were children, my sister and I would drive our cattle to the river close by and take shovels to dig holes in the sands for water, making little mounds here and there. We would dam up the water for another day. Then the thought came to me, if we only had help, wouldn't it be wonderful if we could dam up this stream? Today we are well on the way to materialize that dream of long ago, and we heartily thank the help from the higher channels to bring forth this great cause. Especially do we thank our local Directors, Carl Brown and Irl Gilliland, for their willingness and ability during these many years to carry through this issue to a successful conclusion. We thank everyone who has helped in any way, and there have been many indeed, who furthered this worthy cause that will be a blessing to mankind, and who contributed to the rightful development and good of this, the heart of the Nation, for generations to come.

THE END.

TOO LATE to make the December 1950 story, "Superior-Courtland Dedication," but too good a photo to omit, here are District Manager H. E. Robinson, Miss Republican Valley, Killie Sprage of Red Cloud, Nebr., Regional Director Avery A. Batson of Region 7, and Paul Strouse, Chief Engineer of the Bostwick Unit. ***Photo by Lyle Axthelm, Region 7.***

Straus and McClellan Attend International Conferences

Reclamation Commissioner Michael W. Straus, and Chief Engineer L. N. McClellan left the United States on December 26, 1950, to attend a series of international water resources conferences in India scheduled for early January 1951.

They attended the conferences in the land of the world's largest irrigated acreage as two members of a 14-man United States delegation. Officials of the Bureau of Reclamation and members of the Indian Government have been exchanging technical irrigation service for a long period of time and this visit is expected to cement relations between the two countries.

In addition to the Indian mission, Mr. Straus was scheduled to discuss a number of special ECA, Point Four, and other technical matters with officials in other countries including Italy, Israel, Pakistan, Ceylon, the Philippine Islands, and Guam.

He was to serve both as a member of the United States Executive Committee of the World Power Conference in the American delegation, and as a member of the executive committee of the International Congress on Large Dams during the sectional meeting of the conference in New Delhi January 10 to 15. Mr. Straus was to present a paper entitled "Water and Power in Our World," while Mr. McClellan was to speak on "Feasibility of Irrigation Projects Increased by Development of Hydroelectric Power."

Mr. McClellan attended the meeting of the International Association of Hydraulic Research in Bombay January 3 to 5, and the United Nation's Economic and Social Council's Technical Conference on Flood Control held in New Delhi January 7 to 9. •

All Eyes on Wind River

(Continued from page 36)

(among many other things) about soils, grass, erosion, and the carrying capacity of range lands or in other words, how much livestock can graze on certain types of vegetation, combed the 1,000,000 or so acres of public land in the Wind River Basin, to see what its condition was at the time, and what use could best be made of it. Fortunately most of the area had already been surveyed and corners established. The crews took their plane tables outdoors, and from aerial photos, topographic maps, cadastral surveys and other data, sketched out rough maps, filling elaborate work sheets with information about the type of vegetation, its density, the types of grasses, shrubs, type and seriousness of erosion, type of surface soil, whether it were sandy, stony, rocky, until practically every inch of ground could be described accurately. From these data, they prepared extremely detailed maps, from which e illustrations on pages 34 and 35 were designed, owing the condition of the land at the time of e survey, and how to make the most of it.

Practically the same work went on in the Indian nds and Reclamation project. From these data, e people working on the pilot study saw what d to be done first, and they set out to do it.

(NEXT MONTH: WORKING ON WIND RIVER)

Blast the Silt

(Continued from page 25)

menace. You will notice a block of silt about feet wide, reaching across the pool, left immeately upstream from the weir blade. You will ve to remove this silt with a shovel, but as the periments proved, this residue is insurance ainst damage during the blasting.

In the accompanying illustrations, the pool was out 30 feet long and maintenance man Hoshaw ed 20 half-pound sticks of dynamite. The blast ft the pool about 6 feet wide and 2 to 3 feet deep. 1 less than an hour, one man plus 10 pounds of ynamite excavated and disposed of nearly 20 ibic yards of material.

You might have to modify the procedure somehat to get the best results on your particular rm, but we think it is worth a try. THE END.

anadian River Project OK'D by President

In the closing days of the Eighty-first Congress resident Truman signed the Candian River bill uthorizing construction of the Canadian River roject in northwest Texas by the Bureau of Recmation. This development will permit 11 cities the area to receive additional water supplies dly needed for municipal, industrial, and irriation uses.

Actual construction is dependent upon the raticaion of a compact between the States of New lexico, Texas, and Oklahoma by the Congress oncerning the division of waters and the specific ppropriation of funds by Congress for the necesary work. This latter must be considered in ght of the over-all needs of the defense program.

The 11 cities which can benefit from the legisation are Amarillo, Tahoka, O'Donnell, Lamesa, alton, Levelland, Pampa, Borger, Plainview, ubbock, and Littlefield, all in Texas. •

Neilsen Named Assistant Director in Region 3

EDWIN G. NEILSEN, regional planning engineer in the Bureau's Region 3 at Boulder City, Nev., has been named assistant regional director for that region. He succeeds L. R. Douglass who was recently promoted to the position of director of power at the Boulder Canyon project.

Mr. Neilsen, an engineer with more than 23 years experience, began his professional career with private companies in 1927. He served as assistant engineer with the Public Service Co. of Missouri from 1931 to 1933 and joined the Bureau of Reclamation as assistant engineer in Denver, Colo., during 1934. He was subsequently promoted to associate engineer and later made engineer at the Bureau's Salt Lake City office. Before coming to Boulder City he was the chief of the hydrologic division in the Bureau's Denver Office.

He received his degree of BS from the State University of Iowa. •

O & M Costs

(Continued from page 31)

establishing payments on a current income basis by the use of suitable annual variations which are geared to the productivity of the farms and by making certain that land owners who vote in the contract elections are fully informed of Bureau of Reclamation requirements.

The report and recommendations of the conferees are designed to lead to further action. Some actions are within existing authority of regional and project heads; some actions will require approval by the Commissioner, the Secretary, or the Congress. Regional and Washington Operation and Maintenance Branch representatives will take appropriate steps to give effect to the conference recommendations so the water users will get what they pay for, and a little bit more. THE END.

WATER REPORT

Taking a sweeping glance at Reclamation reservoirs at the beginning of the new year, we see a great contrast—full reservoirs in the Northwest, overflowing reservoirs in California and Nevada, and almost empty reservoirs in the Southwest.

A warm and wet December filled reservoirs in the Columbia Basin well above normal. December floods in California and Nevada, although not reaching the peak flows of November, were heavy enough so some of the water was released to provide storage for future flows and to prevent uncontrolled spilling. Arizona streams barely trickled into the Salt River project's reservoirs, and the runoff of the Salt River above Roosevelt Dam was reported to be the lowest ever recorded in December since the records began in 1913. The flow of the Rio Grande into Elephant Butte Reservoir was less than half its normal amount, and no stored water is being released for winter irrigation.

Here is a closeup of the water storage situation, region by region (see map on back cover to locate areas):

REGION 1—most reservoirs contain more stored water than normal for December, and on some projects water is being released to make room for spring runoff. Although more water than usual flowed into reservoirs of the Vale project in Oregon during December, the reservoirs are critically low for this time of year. Rains and melting snow over the weekend of December 23 swelled the amount of water stored in the Yakima River system.

REGION 2—all stream flow records for the period October 1 to December 31 on the Central Valley project were broken in 1950. At Shasta, 367,000 acre-feet of water was released through the river outlet valves to increase the flood-control reserve, and 140,000 acre-feet was released at Friant. The 140,000 acre-feet released in December was more water than it had in storage in December during the last 3 years. Although the water supply prospects for the next irrigation season are excellent, the snow pack in the Sierra Nevada was seriously depleted during the warm rains of November and December.

REGION 3—reservoirs on the Salt River project are stricken by the Southwest drought. Lake Roosevelt, with an active capacity of 1,398,400 acre-feet contained only about 2,400 acre-feet at the end of December. Salt River project people are taking advantage of the situation by rehabilitating Roosevelt Dam while the water is low. Heavy snows and rains on the watershed of the Salt and Gila rivers are critically needed to assure next season's crops. Looking on the brighter side of the picture, in spite of below normal precipitation in the upper portion of the Colorado River, Lake Mead has a large holdover storage to assure abundant irrigation water for 1951 crops.

REGION 4—in southwestern Colorado, very little snow was reported by the end of December in the drainage area above the Jackson Gulch Reservoir. On the other hand, water was released from reservoirs of the Truckee River Storage and Newlands projects during December to provide space for spring flows because of the California and Nevada floods.

REGION 5—except for the Rio Grande project, reservoirs contain enough water so project farmers should have ample irrigation supplies this year. Lower Parks Reservoir of the Balmorhea project in southwestern Texas has filled, and the Altus Reservoir of the W. C. Austin project in southwestern Oklahoma is nearly full. But on the Rio Grande project in New Mexico and Texas, storage hit a new low for December, with reservoirs storing less water then they have for 32 years during this season.

REGION 6—melting snows in the upper Missouri Basin filled reservoirs in northern Montana's Milk River project so they were above normal for the beginning of the year. A good snow cover in the St. Mary River Basin promised normal runoff. The Buffalo Bill Reservoir of the Shoshone project in Northern Wyoming was three-quarters full, the highest December storage since 1947.

REGION 7—all reservoirs contained favorable storage for the beginning of the year. The North Platte River brought a heavy flow of water, for December, into the Pathfinder Reservoir, probably because the mountain streams were not frozen over due to warm weather.

LETTERS

Louisiana Purchase

PORTALES, N. MEX.,
August 20, 1950.

DEAR EDITOR: I am renewing my sub[scription] to RECLAMATION ERA, for [...] years, enclosed is $5 for same.

Please send the ERA to me at P. [O.] Box 247, *De Ridder*, Louisiana. (D[e] Ridder) is two words.

I am going there to be in charge [of] the sprinkler irrigation for West Lo[ui]siana Experimental Farm which w[ill] be put in operation in Spring of 19[..].

I enjoy the ERA very much and wi[sh] to keep abreast of developments in t[he] West even though I will be in "De[ep] South."

Louisiana has an average rainfall [of] 49 inches per annum but in July a[nd] August they are plagued with drout[h]. It is believed that sprinkler irrigati[on] will be justifiable so I am running [a] 5-year test to determine the practi[cal] application of same.

Respectfully yours,
PAUL E. WHITESELL.

Many thanks to Mr. Whitesell for [his] kind words, and also his 5-year s[ub]scription renewal. It is most gratifyi[ng] to note the interest of people throug[h]out the country in the reclamation p[ro]gram of the West. If Mr. White[sell] is so inclined, we are certain our read[ers] would be most interested in learn[ing] the results of his 5-year test at the W[est] Louisiana Experimental Farm, or [a] positive "do's and don'ts" which he [dis]covers during the course of his inve[sti]gations. May we hear more from [Mr.] Whitesell.—Ed.

RELEASES

New Mexico Coal Reserves M[ore] Than Adequate

New Mexico's coal reserves, rece[ntly] appraised by the Geological Surve[y at] 61 billion tons, are enough to serve [the] needs of that State and supply [sub]stantial amounts for export to Cali[for]nia and Arizona. Convenient rail [con]nections exist for transportation to [both] of these areas.

his supply is an important source of rgy for the State's present needs and contribute to the future industrialion of the West. By comparison, Mexico ranks midway in the list 24 States in the United States havmajor coal reserves. It exceeds iana and Oklahoma by a small ount and has slightly less reserve n Washington and Alabama.

n the more distant future New Mexmay have to depend on coal as a n source of energy, with the developt of commercial processes for the thetic production of liquid fuels from l, and the underground gasification oal (conversion of coal to gas) both which are now in experimental ges.

ppraisals show that the reserve is le up of 50 billion tons of subbitnous coal in beds more than 30 inches k, and nearly 11 billion tons of biinous coal and small amounts of hracite in beds more than 14 inches k.

or complete information, a report d "Coal Resources of New Mexico" C. B. Read, R. T. Duffner, G. H. od, and A. D. Zapp may be obtained hout cost by writing to the Geological vey, Washington 25, D. C. ●

New Reclamation Pamphlet Available

new illustrated pamphlet explainthe how, where, why, and when of lamation, including numerous staics, was recently released by the eau of Reclamation. Copies may be ained free by writing to the Bureau Reclamation, Department of the Inor, Washington (25), D. C., or to of the Bureau's regional offices. In r request, specify the title of the nphlet, which is, appropriately ugh, "Reclamation." ●

New Maps Available

Seven new project maps have recently n released by the Bureau of Reclation, as follows: Bostwick Division, ssouri River Basin, Kans.-Nebr.; nnonball Division, Missouri River sin, N. Dak.; Montana Pumping Divin (Nickwall Unit), Missouri River sin, Mont.; Owl Creek Unit, Big Horn sin Division, Missouri River Basin, o.-Wyo.; Newlands project, Nev., Grande project, N. Mex.-Tex., and Shoshone project, Wyo. These maps are all in color, and available in two standard sizes, 10½ by 17 inches and 21 by 34 inches. Those who wish to obtain these maps, should send their requests to their nearest regional director (see directory on inside back cover of this issue), and specify the name and size of the maps desired. Single copies are free to those who have need of them in connection with their work or studies. ●

POSTSCRIPTS

IRRIGATION PAYS (In Spite of Rain)

James Barker, University of Nebraska Agricultural Extension Engineer in charge of the experimental work at the Anderson development farm near Arapahoe, Nebr., has released figures which show that irrigation in the Frenchman-Cambridge Division will pay off even in years of above-average rainfall. One corn test plot under irrigation on the farm yielded 152.3 bushels per acre. The irrigated corn on the farm averaged 125.8 bushels per acre, as compared with 89 bushels per acre for the nonirrigated corn. Irrigated alfalfa also paid off, Mr. Barker said. The maximum yield of irrigated alfalfa was 6.25 tons per acre, while the top yield of nonirrigated alfalfa was 3.77 tons per acre. ●

Thar's Gold in Californy—Water

During 1950 the United States Government, through the sale of water to irrigation districts, public utility districts, and municipalities, was paid $793,848 for 427,015 acre-feet of Central Valley project water. Preliminary estimates indicated an additional $38,500 in revenue would be earned by the close of the year. The gross CVP power revenues for 1950 total approximately $7,700,000. The grand total revenue from the sale of CVP water and hydroelectric power from Shasta and Keswick Dams, since the first water deliveries in 1940 and the first power generation in 1944, has already surpassed $34,000,000. Of that amount about $2,900,000 represents revenue from sale of project water. ●

Is That Enough?

Almost 40 percent of the land area of the United States receives too little rainfall for safe general agriculture, according to a Twentieth Century Fund survey, but only 3 percent of this area is now being irrigated. ●

Correction

In reprinting Public Law 451, regarding the Bureau's Rehabilitation and Betterment program, on page 239 of the December 1950 issue, a line of type was inadvertently omitted, with the consequence that Public Law 451 appears to delete from Public Law 335 language which does not appear in Public Law 335. We hereby reprint Public Law 451 with the previously omitted line in capital letters.

(PUBLIC LAW 451—81ST CONGRESS)

(CHAPTER 47—2d SESSION)

(H. R. 7220)

AN ACT

To expedite the rehabilitation of Federal reclamation projects in certain cases.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the second sentence of the Act entitled "An Act to provide for the return of rehabilitation and betterment costs of Federal reclamation projects", approved October 7, 1949, is amended by striking out the PERIOD AT THE END THEREOF AND INSERTING A SEMICOLON AND THE following: "except that, any such determination may become effective prior to the expiration of such sixty days in any case in which each such committee approves an earlier date and notifies the Secretary, in writing, of such approval: *Provided,* That when Congress is not in session the Secretary's determination, if accompanied by a finding by the Secretary that substantial hardship to the water users concerned or substantial further injury to the project works will result, shall become effective when the chairman and ranking minority member of each such committee shall file with the Secretary their written approval of said findings."

Approved March 3, 1950.

NOTES FOR CONTRACTORS

Contracts Awarded During December 1950

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contr amou
3168	Fort Peck, Mont.	Dec. 8	3 carrier-current relaying transmitter-receivers, one carrier line trap, 1,400 linear feet of coaxial cahle, and 3 sets of line-protective and carrier-current relays for Fort Peck power plant and Olendive and Miles City suhstations.	Oeneral Electric Co., Denver, Colo.	$15,
DC-3208	Colorado-Big Thompson, Colo.	Dec. 11	Construetion of Bald Mountain pressure tunnel and access roads, Estes Park-Foothills power aqueduct.	Winston Bros. Co., Monrovia, Calif.	1,691,
DS-3209	Kendrick, Wyo.	Dec. 20	One 115,000-volt circuit hreaker for Seminoe power plant additions, schedule 1.	Allis-Chalmers Manufacturing Co., Denver, Colo.	22,
DS-3213	Cachuma, Calif.	Dec. 29	One 38-inch diameter welded-plate steel pipe for outlet works at Cachuma Dam.	American Pipe & Steel Corp., Alhamhra, Calif.	17,
DC-3219	Boulder Canyon, Ariz.-Calif.-Nev.	Dec. 18	Construction of earthwork, pipelines, and structures for laterals 88.6, 91.4, and 93.0, and suhlaterals, part 1 of Unit 9, Coachella Valley distrihution system, All-American Canal system.	R. V. Lloyd & Co., Coachella, Calif.	520,
DS-3223	Missouri River, Basin, Mont.	Dec. 8	Nine 9-foot 4-inch hy 10-foot 8-inch hulkhead gates with hulkhead gate seats and guides, and hulkhead gate lifting beam for Canyon Ferry power plant.	Southwest Welding & Manufaeturing Co., Alhamhra, Calif.	24,
DS-3224	Fort Peck, Mont.	Dec. 1	One 20,000-kilovolt-ampere transformer with three 115,000-volt and three 34,500-volt lightning arresters for Shelhy suhstation.	Pennsylvania Transformer Co., Canonshurg, Pa.	91,
DS-3232	Shoshone, Wyo.	Dec. 13	Olazed metal partitions, metal ceiling panels, and steel platforms for Shoshone power plant.	Macri & Hood Iron Works, Oakland, Calif.	13,
DC-3233	Riverton, Wyo.	Dec. 5	Construction of huried asphaltic memhrane lining for Pilot eanal.	Studer Construction Co., Billings, Mont.	79,
DS-3234	Eklutna, Alaska	Dec. 6	Materials for steel warehouse at Eklutna government camp	Soulo' Steel Co., San Francisco, Calif.	29,
DC-3235	Columhia Basin, Wash.	Dec. 6	Construction of West canal main drains, drain W645.	Peter Kiewit Sons' Co., Seattle, Wash.	149,
DS-3342	Missouri River Basin, Mont.	Dec. 27	Three 12.78-foot hy 21.78-foot fixed wheel gates for penstocks at Canyon Ferry Dam.	Treadwell Construction Co., Midlaud, Pa.	126,
DS-3247	Missouri River Basin, Mont.	Dec. 20	Miscellaneous structural steel, cast steel, and rails for Canyon Ferry power plant.	W. H. Reller Co., Boise, Idaho	14,
R1-CB-71	Columhia Basin, Wash.	Dec. 7	Constructing permanent residences, garages, streets and utilities at O&M Headquarters, Mesa, Wash.	Hunt & Willett, Inc., Brewster, Wash.	127,
117C-88	do	Dec. 13	Constructing fencing for left 115- and 230-kilovolt switchyards and left vista point at Coulee Dam.	McWaters & Bartlett, Boise, Idaho.	23,
200C-137	Central Valley, Calif.	Dec. 4	3-bedroom residences on Friant-Kern Canal, schedules 1 and 2.	L. B. Pipes, Fresno, Calif.	42,
R3-PX-54	Davis Dam, Ariz.-Nev.	Dec. 22	Construetion of warehouse at system O&M area	Mardian Construction Co., Phoenix, Ariz.	59
R3-B-18	Boulder Canyon, Ariz.-Calif.-Nev.	Dec. 15	Streets, sidewalks, eurhs, gutters, and extension of sewerage and water distrihution systems for Boulder City.	Boulder Construction Co., Las Vagas, Nev.	53,
R5-25	W. C. Austin, Okla.	Dec. 6	Construction of earthwork and structures for drain F and Altus Canal wasteway.	Poston Construction Co., Lawton, Okla.	44,
R6-48	Missouri River Basin, N. Dak.	do	Construction of Carrington, Edgeley, and Forman suhstations	Evans Electrical Construction Co., Omaha, Nehr.	135,
R6-49	do	do	Construetion of Leeds, Bisbee, and Rolla suhstations	do	110,
600C-50	do	do	Construction of Lakota and Valley City suhstations	Electrical Builders, Associated, Mayville, N. Dak.	90
600C-51	Missouri River Basin, Wyo.	Dec. 18	Clearing part of Boysen reservoir site schedule 4	Lindquist, Olsen & Co., Camhridge, Minn.	96,
704S-161	Colorado Big Thompson, Colo.	Dec. 6	Transformers, lightening arresters, horn gap switch, disconnecting fuses and relay cahinet for Lemon suhstation, schedule 1.	Westinghouse Electric Corp., Denver, Colo.	46

Construction and Materials for Which Bids Will Be Requested by April 1951

Project	Description of work or material
Boise, Idaho	Construction of 2.3 miles of 4.16-kilovolt transmission line from Anderson Ranch Dam to Anderson Ranch government camp.
Boulder Canyon, Ariz.-Nev.	Construction of steel-framo warehouse, 9,000 feet in area, at Boulder City, Nev.
Buffalo Rapids, Mont.	Construction of surface drains in area A near Olendive, Mont.
Cachuma, Calif.	Construction of 75-foot high, 100,000-cubic-yard earthfill Glen Anne Dam on the west fork of Glen Anne Canyon, 4 miles northwest of Goleta, Calif.
Do	One 36-inch butterfly valve for Lauro Dam.
Do	Chlorination equipment for Tecolote tunnel chlorination and control house.
Do	Chlorination equipment for Lauro control station, South Coast conduit.
Central Valley, Calif.	Replacing two 2-mile wood-pole sections of Shasta-Tracy 230-kilovolt transmission line with steel tower sections hy erecting steel towers, restringing conductor, and stringing new ground wires.
Do	Three 60,000-kilovolt-ampere transformers for Folsom power plant.
Central Valley, Calif.—(Continued)	Motor starters and float switches for Southern Joaquin municipal utility district No. 3.
Do	9 pump manifolds for pumping plants, Southern Joaquin municipal utility district.
Colorado-Big Thompson, Colo.	Construction of 400-cuhic feet per second cap Willow Creek pumping plant, 4 miles nort Granhy, Colo., and construction of 2 mile Willow Creek pump canal.
Do	Construction of 18 miles of 69-kilovolt transmi line hetween Oore suhstation and Muddy Pass station north of Kremmling, Colo.
Do	Two 8-foot hy 7.5-foot top seal radial gates and 5 pound radial-gate hoists for Willow Creek Da
Do	2,500-ampere generator voltage hus structuro for Hill power plant.
Do	Ono 13,000-horsepower generator-motor unit Flatiron pumping plant.
Do	Two 5,000-horsepower synchronous motors for low Creek pumping plant.

Construction and Materials for Which Bids Will Be Requested by April 1951—(Continued)

Project	Description of work or material
[C]olorado-Big Thompson, Colo.—(Continued)	Main control board, annunciator relay cabinet, recording board, 460-volt unit substation, two 460-volt power distribution boards, two 460-volt heating control centers, three 460-volt motor control centers, one 240/120-volt lighting distribution cabinet, one 125-volt distribution and control board, and one 75-kilovolt-ampere lighting transformer for Flatiron power plant.
Do	Main control board, supervisory and distribution boards, two 125-volt battery chargers, two 500-kilovolt-ampere transformers, and one 37.5-kilovolt-ampere lighting transformer for Pole Hill power plant.
Do	Main control board for Beaver Creek substation.
[Col]umbia Basin, Wash.	Construction of a 17-mile unlined reach of East Low canal and 0.5 mile of unlined Lind Coulee wasteway, 10 miles from Moses Lake, Wash.
Do	Construction of 50- by 100-foot machine shop, 30- by 55-foot storehouse, 10-car garage, and two 10-truck garages at Quincy, Wash.; a 60- by 100-foot warehouse, 10-car garage, and two 10-truck garages at Othello, Wash.
Do	Construction of 150- by 70-foot machine shop at Othello, Wash.
Do	Construction of a municipal building for the city government of Coulee Dam, Wash.
Do	Construction of a building for housing radio receiving and transmitting equipment at Ephrata, Wash., and radio equipment buildings at Quincy and Othello, Wash.
Do	Construction of 54 miles of safety fence, cattle guards, and gate between Soap Lake and Quincy, Wash., and near Moses Lake, Wash.
Do	Installing a 16,000-pound radial gate and hoist in a check structure at station 1992+70, West canal, 5 miles southwest of Quiney, Wash.
Do	Drilling about 40 drainage observation wells near Moses Lake and Quiney, Wash.
[D]o	Grading and surfacing about 5,000 square yards of driveways and parking areas at Ephrata field office site.
[Dav]is Dam, Ariz.-Nev.	Erecting steel structures and installing electrical equipment for Cochise substation, southwest of Willcox, Ariz.
Do	Construction of concrete spillway stilling basin at Davis Dam.
[Des]chutes, Oreg.	Drilling test holes at Haystack Dam near Madras, Oreg.
[For]t Peck, Mont.	Construction of pole top extensions and stringing 35 miles of two 3/8-inch galvanized steel overhead ground wires on the Fort Peck to Wolf Point section of Fort Peck-Glendive 115-kilovolt transmission line.
[Hun]gry Horse, Mont.	High potential test set for Hungry Horse power plant.
Kendrick, Wyo.	Construction of 3,750-kilovolt-ampere Rawlins substation.
Do	Construction of 30 miles of Sinclair-Hanna 34.5-kilovolt transmission line.
Do	Construction of laterals and concrete structures on Johnson sublateral extension, 13 miles northwest of Casper, Wyo.
Do	Two 160-inch turbine butterfly valves for Alcova power plant.
Missouri River Basin, Colo.	Construction of 3,000-kilovolt-ampere Julesburg substation.
Missouri River Basin, Mont.	One 9.04- by 9.04-foot fixed wheel gate lifting frame, 1 gate engagement indicator, and 4 gate slot closures for Canyon Ferry Dam.
Missouri River Basin, Nebr.	Spillway stop log guides for Trenton Dam.
Missouri River Basin, N. Dak.	Construction of 750-kilovolt-ampere Fort Clark substation, near Stanton, N. Dak.
Do	Construction of 4 miles of Garrison (Fort Peck tie) 115-kilovolt transmission line connecting Williston-Garrison and Garrison-Bismarck lines at Garrison Dam, N. Dak.
Do	Construction of Fort Clark pumping plants, canals, laterals, and surface drains near Stanton, N. Dak.
Do	Construction of short distribution lines and small substations to serve Fort Clark pumping plants.
Do	Relocation of 2 miles of county road and raising county bridge near Dickinson Dam site.
Do	Construction of a permanent camp at Heart Butte Dam near Glen Ullin, N. Dak.
Do	Supervisory control and selective telemetering equipment for 12 substations controlled from Jamestown substation.
Missouri River Basin, S. Dak.	Construction of 3,750-kilovolt-ampere Gregory substation.
Do	Construction of a camp at Shadehill Dam site.
Do	Main control boards, distribution boards, and battery charging and control equipment for Sioux Falls, Huron, and Watertown substations.
Missouri River Basin, Wyo.	Construction of 15,000-kilovolt-ampere Boysen switchyard.
Do	Installation of equipment for 15,000-kilovolt-ampere Boysen switchyard.
Do	Grouting contraction joints at Kortes Dam, 62 miles southwest of Casper, Wyo.
Do	Construction of 24 miles of 34.5-kilovolt transmission line between Pine Bluffs, Wyo., and Kimball, Nebr.
Rio Grande, N. Mex.	Construction of 7,500-kilovolt-ampere Willard substation.
Do	2 control boards, 2 battery chargers, and 2 distribution cabinets for Belen and Willard substations.
Shoshone, Wyo.	Placing asphalt lining on various reaches of Heart Mountain canals and laterals, totalling about 25 miles, 10 miles north of Cody, Wyo.

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Oscar L. Chapman, Secretary
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Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1 a year for persons residing in the United States and Canada; $1.50 a year for foreign subscriptions; special rate of 50 cents a year for members of water users' associations, and Bureau of Reclamation employees.

OUR FRONT COVER

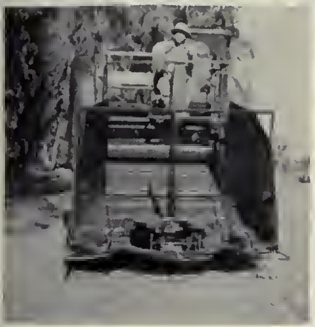
PLOWING, PLANTING, PRAYING, plus hard work made the miracle of Ralston Bench (see page 226, December 1950 issue of the *ERA*). Ralston Bench settler A. G. Kamm is a typical example of the hard-working farmers of the Shoshone project who drew farm units in September 1949, and put them in crops within a year. Photo by Charles Knell, Region 6 photographer.

30 YEARS AGO IN THE ERA

The season is here when tree planting on most of t projects might occupy to advantage some of the attentl of our farmers, their boys and girls. Last year we we pleased to note that a number of our farmers had giv thought to this subject and had set out trees of sever varieties along the roadsides, ditch banks, and about t homes. This movement set in some years ago on the Orla project, where concerted efforts were made to encoura tree planting. The results have been most gratifying.

(From Current Comments, Gathered from the Proj Press and People, by C. J. Blanchard, Statistician, page 1 of the March 1921 issue of the RECLAMATION RECO predecessor to the RECLAMATION ERA.)

RECLAMATION PLACE NAMES IN THIS ISSUE



CASTOR BEANS for Peace or War

HARVESTING castor beans after frost on W. C. Austin project in top photo. COMBINE is fitted with castor bean attachment to handle "dwarfs" immediately above. HULLING PLANT—Beans unloaded by suction pipe and weighed in bin scales. ***Lower inset submitted by the author, other photos by P. W. George, Region 5.***

by W. E. DOMINGO, Director of Agronomy, The Baker Castor Oil Co., New York

Castor beans have two-way possibilities. During peace time the crop provides needed diversification and cash income. If war is ahead, the crop takes on special military importance and its culture will benefit not only the grower but the defense effort.

Over the past 50 years, chemists have found scores of industrial uses for castor oil and its derivatives. They have put castor oil products in everyday items like paint, plastics, varnish, nylon, cosmetics, rayon, hydraulic fluids, textiles, lubricants, asphalt tile, and electrical systems. One major castor oil producer sells 185 products made from castor beans, with about 100 other products in the development stage.

Today, the defense agencies are urgently demanding products from castor beans for use in military equipment, materials, and supplies.

The demand has long exceeded the world supplies of castor beans, and because of the present international situation, no foreign source of any item can be assured. Therefore, there is a definite need for culture of castor beans as a farm crop in the United States. Estimates on the land area necessary to satisfy anticipated needs for castor bean products range from 100,000 to 1,500,000 acres depending on areas of production (yields per acre) and costs of production per pound of beans.

Castor beans in the United States are domesticated wild rogues of the tropics. In its native state the castor bean is a robust perennial that dehisces (bursts open and ejects) its seeds violently. Since most types introduced into this country bloom little the first year and since the plant is sensitive to frost, breeders concentrated first on producing a plant that would bloom early. Whereas many castor plants grow to 12-foot heights and produce as many as 40 nodes during a growing season without blooming, several strains now available flower at the sixth node, which is only some 10 inches from the ground. Further, breeders have developed short slender plants with spikes which resist shatter and dehiscence. These new "dwarf" varieties, which are adapted to specific areas within the United States, are now available in quantity and are being used on commercial acreages in those areas exclusively.

Castor-bean plants grow, develop seed heads, and mature most rapidly in a dry, hot atmosphere. In such a climate, fungal diseases are kept to a minimum, and the mechanical harvesting and hulling processes are most easily performed. However, the crop cannot be classed as drought-resistant—a short period of stress for moisture can be very damaging to castor-bean development and yield. The plant's indeterminate habit of growth means that the longer the season the greater the yield. The irrigated valleys of the Southwest are choice locations for castor beans—and both experimental data and field experience bear that out. Farmers are testing the agricultural and commercial possibilities of raising castor beans under irrigation in the Imperial Valley and San Joaquin Valley of California and on the W. C. Austin project in southwestern Oklahoma. As the techniques of culture and the pattern of marketing become fixed, the crop will no doubt expand into similar areas of the South and West. The national emergency may accelerate production, possibly during the 1951 season.

Castor beans are raised much like cotton. The crop needs a well-drained soil and, under most conditions, only a little fertilizer. It is grown in rows with cotton equipment, except for special planter boxes. Because of the large seed and long germination period, castor beans are preferably "irrigated up." The crop uses upward of the same amount of water as cotton, depending on area and the period of year of culture. Like cotton, the castor-bean plant must be stripped of leaves (defoliated) before harvesting. For post-frost harvesting the crop is conveniently defoliated by the first subfreezing temperature. For prefrost harvesting, defoliation is accomplished on some soils by withholding irrigation water and on others by chemical solutions applied by airplane. The latter is usually very profitable in that it permits a longer period of active seed-set.

As the plant and stem sizes were reduced, combine harvesting came within the range of practicability. The serious problem—the loss of shattered capsules in getting the plant cut and into the machine—was solved through the joint efforts of many people and agencies, including designers and manufacturers of harvesting equipment, and growers. Today the Massey-Harris Co. has available a castor bean combine harvester with an efficiency well within the range of that now accepted on other crops. That combine is basically a grain or peanut machine with a special castor bean attachment on the front end. It removes the three-segmented capsules from the plant. A separate hulling operation, at present, is needed to remove and separate the hull from the bean.

Hulling equipment has been greatly improved in the past few years. Now available on the market is a portable huller which operates at field-edge serving two combines simultaneously with the harvesting. Clean beans are loaded in trucks for bulk movement to points for consolidation and shipment in carload lots to extraction plants.

All costs of production including harvesting, hulling, and movement to consolidation points, but exclusive of land rental, are estimated to be some $50 to $60 per acre.

The dwarf varieties can be grown for the full season in the areas mentioned without growing excessively tall. With good cultural methods, yields for that period will be from 2,500 to 3,000 pounds per acre. These varieties also are being "double-cropped" in those valleys with long growing seasons by following spring-harvested vegetables, grain, flax, or potatoes. The shorter grow-

(Please turn to page 50)

LONG and SHORT of it. Here is a field of Conner castor beans, for nonirrigated farms. At right, the "dwarf" variety of castor bean for Irrigated areas. Left photo by P. W. George, Region 5, photo at right submitted by the author.

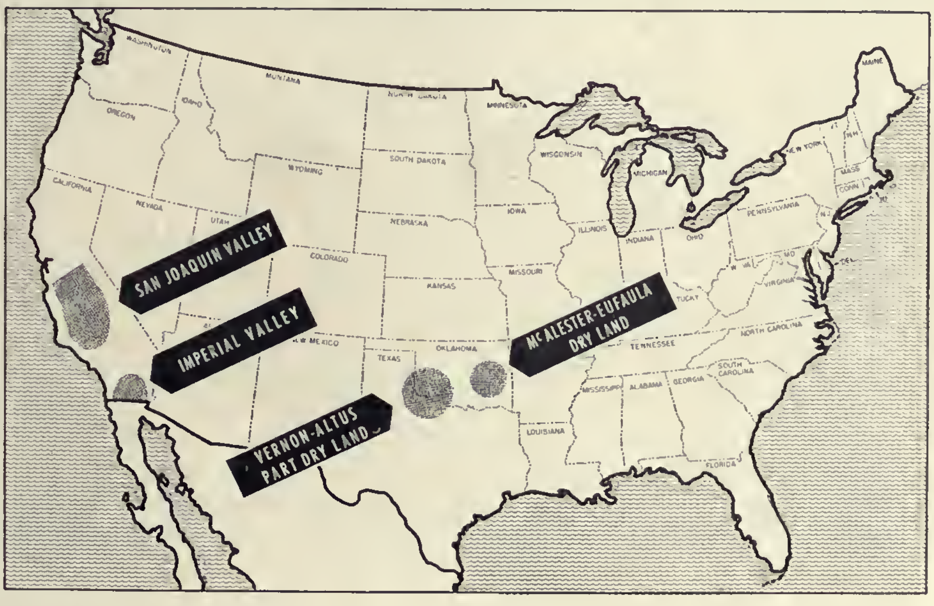
THE CASTOR BEAN OUTLOOK

by D. M. CROOKS, Head Horticulturist, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, United States Department of Agriculture, Beltsville, Md.

Only recently has the castor bean plant taken on aspects of a promising agricultural crop. Heretofore in the United States it has been more of a dooryard ornamental weed or a subject for experimental testing and development. Unlike many of our established crops, its products were in great demand for a multitude of industrial uses in advance of the development of any varieties suitable for crops as measured by American standards of agriculture.

An adequate supply of castor oil or its products from foreign sources before and after World War I, with the consequent development of many new and important industrial uses, led to a serious domestic situation when supplies were limited during the two world wars. Since World War II, the supply situation is increasingly more difficult because of ever-increasing uses of the castor-oil products. During the past decade the possibilities for domestic production have changed entirely with the development of acceptable varieties through scientific breeding and selection for yield, local adaptation, and mechanical handling. The new varieties fulfill the general requirements of any good crop plant for uniformity of plant type and seed, acceptable yields, fair freedom from disease, economical crop handling by machinery, and mechanical hulling. All of these factors must now be developed concurrently for a successful crop. The variety development is basic to all other advances for the castor-bean plant to take its place as a major United States crop. Only with the development of the several new varieties did castor beans become a potential crop for the irrigated regions. While the varieties now at hand are acceptable for crops in the specific regions where they were developed, and far ahead of anything known prior to World War II, they are only a beginning for what may be expected with continued efforts in the same directions within the next 10 years.

Farmers in many areas need new crops, and the important industrial uses of castor beans are sufficient to require the production of from 300,000 to 400,000 acres annually. The varieties recently developed are acceptable, and better ones for improved yields, easier handling, and new areas, are within sight. The potential for a sizeable castor-bean crop is high and within reach. •



TODAY'S castor bean centers are depicted by arrows on map based on information supplied by the Baker Castor Oil Co. of New York. National defense needs may prompt a vast extension of these areas. ***Map by Graphics Section.***

Texas, and Oklahoma, and until funds are specifically appropriated by the Congress.

The project is designed by the Bureau of Reclamation to provide municipal water supplies for 11 Texas cities—Amarillo, Borger, Pampa, Plainview, Lubbock, Tahoka, O'Donnell, Lamesa, Slaton, Levelland, and Littlefield. These cities now obtain water from drilled wells, and Geological Survey records show that current withdrawals in the area are more than 20 times greater than ground-water replenishments.

Possibilities of a dam and storage reservoir on the Canadian River in Texas, approximately 237 river miles downstream from Conchas Dam, which stores water for the Tucumcari, N. Mex., irrigation project, were first noted by the late Sid Stinnett of Amarillo. Mr. Stinnett was instrumental in the creation of new communities on the Texas plains, helping to bring railroads into the area; helping to build modern highways, schools, colleges, and many other necessities and conveniences in a new and progressively expanding region. Fate called for Mr. Stinnett's plans for a dam on the Canadian in Texas to pass to other, younger builders of the West.

By 1948, officials of cities throughout the project

The Canadian River Project

by GARFORD L. WILKINSON, Regional Information Officer, Region 5, Amarillo, Texas

ELEVEN TEXAS TOWNS will benefit from the Canadian River project. Two typical towns are shown at upper left, Pampa (top) and Lubbock. *Photos courtesy of the respective Chambers of Commerce.*

A DREAM, CONCEIVED IN THE MINDS OF EARLY-DAY COMMUNITY BUILDERS and nourished by present-day residents concerned about ample water supplies for rapidly expanding metropolitan centers in the Panhandle-Plains area of Texas, moved a step nearer realization on December 29, 1950, when President Truman signed a bill authorizing the 85-million dollar Canadian River project.

Actual construction of the project cannot begin until consent of the Congress has been granted to a compact providing for the division of the waters of the basin among the States of New Mexico,

area had become increasingly alarmed about the declining ground-water tables, and the increasing population in a rich oil, helium, gas, wheat, and cattle-raising region. Civic leaders, then as now, believed that the cost of constructing a dam on the Canadian River could be justified if other advantages resulting from the dam and reservoir were considered along with flood control. From this came a plan for a multiple-purpose project providing for municipal and industrial water supplies, fish and wildlife propagation, recreation, irrigation, and flood control.

Project studies were initiated by the Bureau under direction of Regional Director H. E. Robbins on March 1, 1949, and a preliminary report on these investigations was presented to the public on June 17, 1949.

Hardly had the report been received by businessmen in the area until they were talking on long-distance telephones with their representatives in Washington, D. C. Key spokesmen for the area were checking airline schedules linking the Panhandle with the Nation's Capital.

Success rewarded their efforts, and with the help of former Representative Worley, Congressmen Mahon and Rayburn, Senators Johnson and Connally, and other Texas representatives, the Canadian River project was authorized in the closing days of the Eighty-first Congress.

The Canadian River project dam is designed as an earth-fill structure, 7,200 feet long with a top width of 40 feet. Maximum height will be 186 feet. Cost of the project, including the dam and reservoir, a water-transportation system to serve project cities, irrigation and recreational features, moving Amarillo's sewage plant, and all rights-of-way, is estimated at $85,383,000.

INDUSTRY—Borger, Tex., above, will benefit from CANADIAN RIVER development, damsite shown above right. For example, OIL REFINERY near Amarillo, Tex., at right.

The project's reservoir will extend 20 miles upstream from the dam. It will have a capacity of 1,956,000 acre-feet of uncontrolled super storage. The reservoir will cover 26,300 acres. The dam site is at Sanford, near the city of Borger, Tex., about 50 miles northeast of Amarillo.

The authorization act provides for repayment by the cities of the municipal and industrial water supply features of the project. The estimated cost tentatively allocated to these features is $77,892,000. This cost, plus interest to be designated by the Secretary of the Treasury, is to be repaid over a period of not more than 50 years.

None of the 11 cities will be required to advance funds for construction. A central organization will contract with the Federal Government to purchase water from the project's system for a specified period of years and the payments will be made on an annual basis, similar to plans used by many public utilities.

"The Canadian River project," said Secretary of the Interior Oscar L. Chapman recently, "will be an important example of basic conservation. Water now flows down the river valley to the sea, while at the same time whole communities are undermining their future prosperity by the exhaustion of their ground-water supplies. This project is not only an economical means of providing the additional water the project cities will need for their future growth; it is also a means of preserving our heritage of fundamental resources."

Commissioner Michael W. Straus noted that project investigations indicated clearly the need for the water-supply project. Population of the project cities in 1950 was approximately 265,000. Commissioner Straus observed that the anticipated population of the 11 cities will increase greatly by the year 2000, when the new system will have been practically paid for by the water users.

Among the many persons who have contributed greatly to the success of the project up to the present time are Amarillo's Mayor Gene Klein, its Chamber of Commerce Manager Rex Baxter, John L. McCarty, president of the Panhandle Water Conservation Association, Lawrence Hagy, Jay Taylor and J. E. Cunningham; Borger's Mayor George Finger, its City Manager A. A. Meredith, and Borger citizens Joe Cooley, Fritz Thompson, Hudson Davis, and Welson Jolly; Mayor Sam Richardson of Lamesa; Clarence Whiteside, chairman of the Canadian River Project Organization and State Representative Preston Smith, E. K. Hufstedler, and Irvin Jones, all of Lubbock; Art Chesher of Littlefield; O'Donnell's Mayor R. O. Stark; Pampa's Mayor C. A. Huff, its City Manager Dick Pepin, Chamber of Commerce Manager E. O. Wedgeworth, and Pampa citizen Fred Thompson, and Plainview's Col. Winfield Holbrook.

Newspapermen in the area also have performed yeomen service in keeping the people informed about the need for and work being accomplished on the Canadian River project. THE END.

CANADIAN RIVER PROJECT—represents a Texas water boon. *Drawn by Graphics Section, Wash., based on Region 5 map.*

Castor Beans for Peace or War

(Continued from page 46)

ing period under this plan reduces yield to some 1,500 pounds, but the land rental borne by the beans is, of course, reduced.

During the last quarter of 1950 the price of castor beans delivered to scattered receiving points of one major company has been in the range of 9 to 10.9 cents per pound, depending on location.

These concurrent developments in the fields of variety improvement, adaptation, cultural methods, mechanical harvesting, mechanical hulling, and marketing have laid a sound foundation on which domestic castor-bean production can be built as either a normal peacetime development or a wartime emergency. THE END.

Dexheimer's Mission Aids Private Business

At the request of the Australian Government, W. A. Dexheimer, assistant construction engineer of the Bureau's Denver Federal Center, served as a technical adviser to that Government on two large Australian water projects—Snowy Mountain power and irrigation project, and the Kiewa tunnel.

In presenting his report, Mr. Dexheimer suggested that Australia should take advantage of world experience by letting contracts to overseas firms capable of carrying out the design and construction for various phases of the work. Upon issuing a statement to the press, Australia's Minister for National Development, Mr. Casey, supported this view, saying, "It would not be possible for Australia to try and carry out all the works required for our rapidly expanding economy from the resources available within this country." •

SURVEYING—Bureau of Land Management crew at Logan Gulch on Muskrat Creek, tributary of Wind River (above). *BLM photo.* SILT CARRIER Five Mile Creek as it meets the Big Horn River (right). *Photo by Charles A. Knell, Region 6.*

All Eyes on WIND RIVER

Part Two

WORKING ON WIND RIVER

by C. C. BUTLER, Land Use Specialist, Branch of Operation and Maintenance, Region 6, Billings, Mont.

"More detailed information is now available on the resources of the Wind River Basin than any other watershed in the United States. These data will form the basis for a conservation program that will show the world what can be done with an entire watershed in using land and water resources in such a way that the greatest benefit will be provided the greatest number of people." These were the words of W. G. Sloan, then chairman of the Interior Missouri Basin Field Committee as he summarized the accomplishments of the various Interior Department agencies at the special Field Committee meeting held at Riverton, Wyo., November 7–9, 1950.

Since April 1948, technicians of the Bureau of Reclamation, Bureau of Indian Affairs, Bureau of Land Management, Geological Survey, Fish and Wildlife Service, Bureau of Mines, and the Weather Bureau have been combing the watershed from the highest peaks of the Wind River Range to the Wind River Canyon to obtain basic information for the most complete conservation program ever planned for a basin.

The Bureau of Land Management and the Bureau of Indian Affairs have completed the land classification and land resources inventory, covering approximately 3,650,000 acres, or 70 percent of the watershed area, excluding only the irrigable lands of the basin.

The Geological Survey and the Bureau of Reclamation joined in completing hydrologic studies of the basin to determine how much water each significant watershed might discharge normally or at a maximum. These studies showed that annual runoff from the Wind River Mountains is generally large in amount, comparatively stable and forms a dependable flow for irrigation and other water development. The Bureau of Reclamation developed a report entitled "Peak Discharge Study of the Wind River Basin," for use in flood control work. The Weather Bureau of the Department of Commerce, cooperating with the Bureau of Reclamation, furthered this study by installing and operating a cooperative network of meteorological stations, which almost quadruples the former density of coverage on the watershed prior to 1948.

When the Wind River investigations were initiated, no one knew where the large quantities of silt which were being carried out of the basin were coming from. The Geological Survey drew the assignment of answering this question. The gaging station at Thermopolis was supplemented by stations on all the tributary streams of the Wind River, concentrating on Five Mile and

Muddy Creeks, known to be heavy contributors of silt. Although preliminary, analysis of these data show that about 4 percent of the total water runoff came from above the Riverton project, about 88 percent came as direct runoff from the irrigation project, and the remaining 8 percent from small unmeasured drains and subsurface percolation into the channel. Further analysis indicates that approximately 86 percent of the silt loss was derived from the stream channel throughout the 28-mile stretch through the Riverton project, about 10 percent from the irrigated lands and the remaining 4 percent from the watershed lands above the irrigation project. The 1950 records generally confirmed those of 1949.

During 1949 Muddy Creek had only natural flow, as no waste water from irrigation was emptied into the creek. During 1950 new settlers irrigated a few hundred acres in the North Portal area of the Riverton project and dumped waste water into the creek channel. As a result, runoff and silt load increased ten fold over the 1949 record. The increase was due in a large part to operational waste.

Analysis of the silt load in the main stream below the lowest tributary shows that 45 percent of the silt originated in Five Mile Creek, 18 percent in the Wind River and Popo Agie River, 13 percent in Muddy Creek, 5 percent in Bad Water Creek, and the remaining 19 percent from other tributaries.

With this information on where the silt was coming from, the three agencies that manage public lands in the basin explored using various types of dams and reservoirs to keep it under control.

Technicians of the Bureau of Indian Affairs covered each subwatershed on the Indian reservation and located 240 sites for retention and detention dams, and 100 diversion dam sites for water spreading. Under the soil and moisture conservation program 127 small dams of various types have already been constructed.

The Bureau of Land Management surveyed areas of the public domain for the same purpose and during the preliminary survey located possible sites for 47 large silt detention reservoirs, 460 small retention dam sites, and 135 reservoirs strictly for stock watering. On Logan Gulch of Muskrat Creek the sites are being resurveyed to determine if proposed reservoirs would provide the necessary storage for a 50-year-frequency storm.

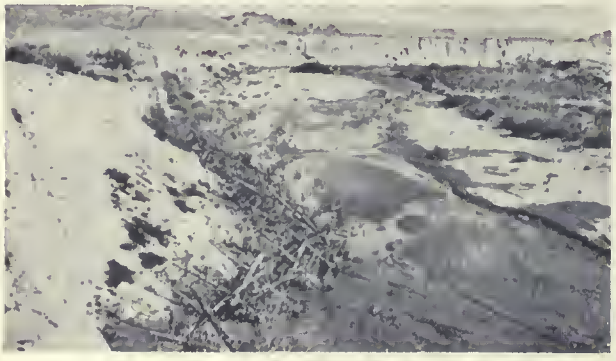
The Bureau of Indian Affairs is also conducting the same type of investigations on Five Mile and Muddy Creeks above the Riverton project.

The Bureau of Reclamation has located and surveyed three such sites for the larger reservoirs, one on Five Mile Creek, and two on Muddy Creek above the irrigated lands. These sites would provide a combined flood storage of 103,500 acre-feet and cover 2,400 acres.

The field committee also asked each of the three action agencies to find out whether various kinds of vegetative plantings would be effective in stream bank stabilization and erosion control. In the upper watersheds of the public domain the Bureau of Land Management selected 7 sites for stabilization of small stream banks covering approximately 48 miles of stream channel. During 1949 and 1950, 48,600 willow cuttings, 16,200 Russian Olive seedlings, and 300 cottonwood trees were planted. In addition 400 lineal feet of live

(Please turn to page 60)

SOIL AND WATER SAVING *willow spiders are planted under Bureau of Indian Affairs supervision (left). Note how they take root and sprout, growing stronger every year. Golden willows are planted near Five Mile Creek by Reclamation crew. Left photo courtesy of the Bureau of Indian Affairs. Right by T. R. Broderick, Region 6, Bureau of Reclamation photographer.*



PEACE AND PLENTY—The goals of the participants in the Fourth Inter-American Conference on Agriculture are typified in this poster set up in Montevideo, Uruguay, in honor of the event. The effectiveness of this huge and vivid symbol, with the flags of the participating nations below it, is somewhat diminished in the black and white photo at right. *All pictures illustrating this article were made from Kodachrome slides taken by the author.*

Latin-American Resources

by WESLEY R. NELSON, Assistant Commissioner of Reclamation

Latin America, a land of great contrasts, with glaciers and jungles, Alp-like mountain peaks and desert oases, swamps, and smoking volcanoes, is also a continent with great potentialities for water-resource development. Immediate possibilities for development are also variable, depending upon the physical, social, economic, and political climate of each area.

When I was appointed as a member of the United States delegation to attend the Fourth Inter-American Conference on Agriculture at Montevideo, Uruguay, last year, I was able to serve in a dual capacity, as a technical advisor to the conference, and a consultant on the possibilities of the United States providing technical assistance to our Latin-American neighbors under the President's Point Four Program.

The globe on page 54 delineates the route taken to cover these assignments, with indications of points of interest which were viewed during the tour.

At San Salvador was a scene typical of Central America—a beautiful, modern, metal and marble airport building, with glittering airplanes, symbol of modern transportation, and a few steps beyond, primitive oxcarts hauling sugarcane.

At Managua, Nicaragua, the possibilities of developing the water resources of that country were discussed with the government officials. Nicaragua has rivers running all over the place, one of the greatest being the Rio Grande which flows from the west to the east, and empties into the Caribbean Sea. There is very little irrigation, and this is accomplished by simple diversions. Nicaragua is the largest of the Central American States, and its two lakes, Managua (30 miles long by 15 miles wide), and Nicaragua (100 miles long and 45 miles wide) are two of its most prominent features.

Hot springs might be developed as a source of electric energy, similar to installations in Italy, and there are tremendous possibilities for hydroelectric development—as much as 700,000 kilowatts. One potential power drop could be developed from Lake Managua, which now drains into Lake Nicaragua, by damming the River Tipitapa, diverting into Lake Managua the streams which now flow into the Caribbean, or into Lake Nicaragua, and dropping these waters into the Pacific Ocean.

The people in Nicaragua agree on the need for water-resource development and are waiting for a plan which would be possible for them to carry out.

In Peru, the land of the Incas, the people have been irrigating for hundreds of years, and more than a million acres of land are under irrigation. In general the remaining irrigation development would be most costly, involving transmountain diversions. Peru is also multiple-purpose minded, and is now developing a project on the Santa River similar to our TVA.

Short rivers run to the sea from the high Andes and many of these have tremendous hydroelectric potentialities which could be easy to develop. The glaciers and glacier lakes of Peru present many problems of engineering which we recommended be referred to technicians familiar with engineering in Switzerland where similar problems have been encountered. One specific problem on which the Peruvians asked for assistance was that of lining high-pressure tunnels.

Perhaps something should be said about Peruvian weather. The climate at Lima is like that of San Francisco except that it has not rained in about 25 years. Cool, and overcast most of the time, the streets are often wet, but from condensation, not from rain. About every 20 years, an unusual juxtaposition of the cool Humbolt Current from the south and warm December winds from the north bring terrific storms to the coast of Peru. Before these onslaughts of nature, man and his works are unprepared, and the damage is great.

Bolivia, the "Switzerland of South America" has two capitals, any kind of climate from equatorial heat to Arctic cold, great mineral wealth, tremendous water resource potentials and wonderful opportunities for development, retarded only through lack of opportunities for the natives, lack of purchasing power, transportation, and trade

THE LAND OF GREAT CONTRASTS as photographed by Assistant Commissioner of Reclamation Nelson during November and December 1950. The map at lower left delineates his trip by plane and ship. Above the map, the Andes, with fertile valley lands. Immediately above, the cableway near Sao Paulo, west of Santos, built by British engineers, showing the trestle over which the train runs, and evidence of the "best job of surface drainage" Mr. Nelson reports having seen. At upper right, symbols of modern and primitive transportation at San Salvador. At extreme upper right, another view of the Sao Paulo cableway, indicating the great heights to which it climbs.

outlets. Although the legal capital is at Sucre, La Paz (meaning "peace") is more accessible and is the actual seat of government. La Paz lies in the heart of a gigantic canyon about 3 miles wide, 10 miles long, and 1,500 feet deep. Despite the depth of the canyon, La Paz is at an elevation of about 12,700 feet—and it is not on the level.

walk is an arduous undertaking for those unaccustomed to the high altitude.

Near Cochabamba is the Angostura Dam, whose name indicates how closely related we are to South America. The word means "narrows" and the dam was built and named by a Mexican engineer, as it was similar to the Angostura Dam he had built in Sonora, Mexico. Homer Derr, the South Dakota State engineer, worked on the South American dam and when seeking a dam site in his home State was so reminded of the Bolivian "narrows" that he named it Angostura (see the December 1949 issue of the RECLAMATION ERA for "Angostura Shows the Way").

Bolivians are having a great deal of trouble with their Angostura Dam. It is now storing silt at a rapid rate, and some of the irrigated land is going out of production because of alkali and seepage.

In Bolivia and Peru is famed Lake Titicaca, the largest lake in South America (4,000 square miles), and the highest lake in the world used for navigation by steamboats. It is 12,500 feet above sea level.

Although Bolivia's greatest wealth at the present time is in its minerals, it is a potentially rich agricultural country, and the majority of the natives raise crops for a livelihood under most primitive conditions. Because of Bolivia's particular problems we recommended sending one drainage engineer to that country to tackle the immediate problem of rehabilitating the Angostura project, and an irrigation engineer to explore the development of simple diversion projects which could be built by the water users with the technical assistance and guidance of the government. Bolivia needs technical assistance and development, but due to many social and economic factors would not be fully able to utilize extensive irrigation and hydroelectric power projects at the present time.

Chile was in direct contrast to Bolivia. Here Point Four could be put into reverse, as engineers from many countries could learn a great deal from the excellent technicians in Chile. Around Santiago is the Central Valley, a large green irrigated area containing many orchards. A development corporation is now building for the State a comprehensive water-development program, including hydroelectric plants and transmission systems to make low-cost power available to the whole country. Recently Chile has considered developing irrigation from underground water in the strip of desert along the coastline. As I flew above this area, I could see the tiny rivulets as they trickled down the Andes, across the white sands of the desert, and vanished from sight, never to reach the sea. Dotting the desert are many small oases, where simple diversion irrigates many crops including citrus.

From Santiago to Buenos Aires, the plane does not fly above the 22,000-foot peaks, but dodges in and around them, including Aconcagua, between Argentina and Chile, the highest mountain peak in the Western Hemisphere. A beautiful airport is being built 35 miles from Buenos Aires, and a four- to six-lane highway provides an impressive approach to that city. Argentina does not want to be considered undeveloped, and officials seem to feel that the country would prefer to be on the sponsoring, rather than the receiving, side of the Point Four Program.

Uruguay offered a contrast to many Latin countries, for here was evidence of a strong middle class. Uruguay is about the size of North Dakota, and in natural resources is like a cross section of western United States. Citrus groves appear close to the coast and as the elevation rises, there are truck farms, wheat and corn. Farther north is the plains country similar to the high plains of Texas, with one notable exception—rheas graze along with cattle and sheep. A multiple-arch dam and 120,000 kilowatt power plant, located on the Rio Negro, near the geographic center of the state, is busily producing energy for Montevideo and the adjoining countryside.

A large delegation of experts from the Unite
States attended the Inter-American Conferenc
on Agriculture, and the regional conference o
the Food and Agriculture Organization of th
United Nations at Montevideo. There was com
plete harmony in the discussions of the commis
sion of which I was a member and the resolution
emphasized the need for the different countrie
to develop basic data necessary for determinin
the appropriate methods and kinds of wate
resources development. Numerous recommen
dations on specific problems of agriculture wer
developed by the conference.

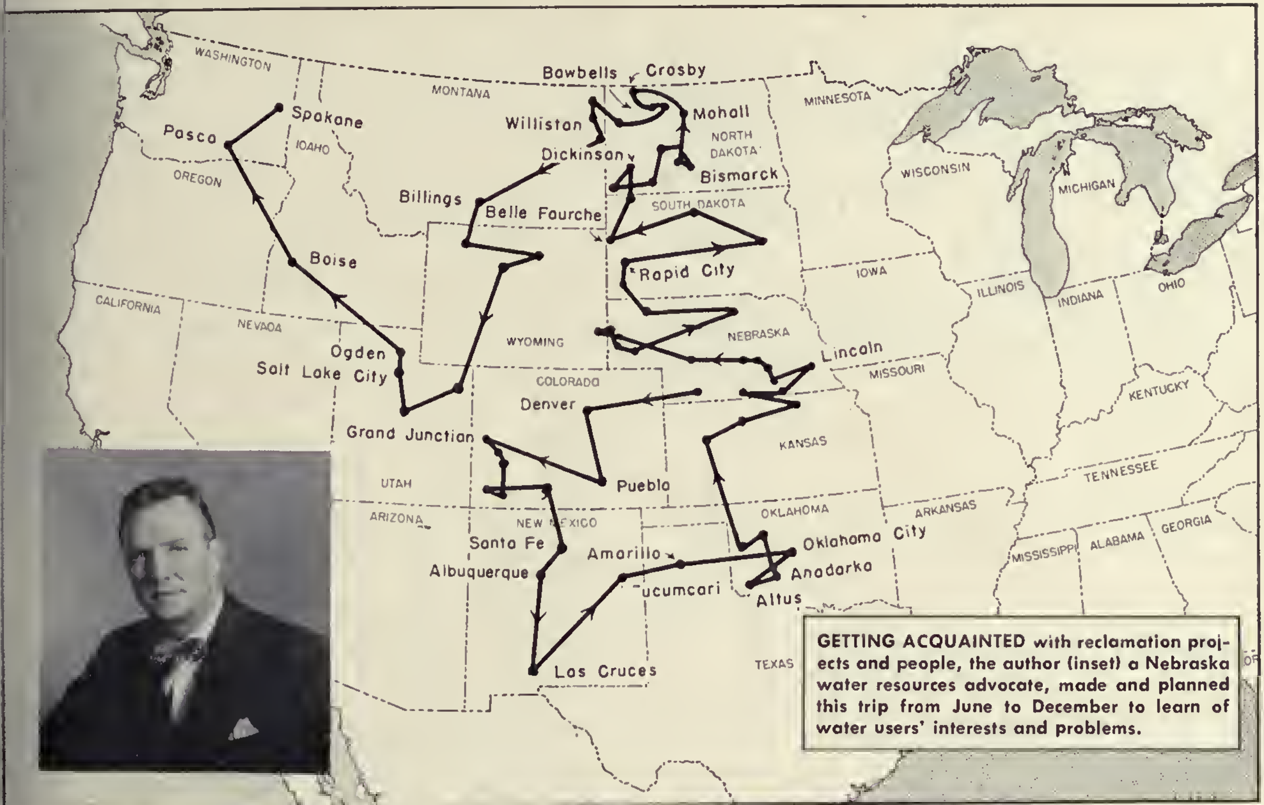
I left the country, feeling that there were tre
mendous natural resources available in most o
these Central and South American countries, an
that the doors of this storehouse of untold wealt
could be readily unlocked through the knowledg
and skills of today's technicians. THE EN

Vasey Surveys Colombia's Budget

Tom K. Vasey, regional programs and financ
officer at Sacramento, Calif., went to Bogota
Colombia, early in November 1950 for a 5- t
6-month assignment as part of the Public Ad
ministration Survey being directed by Lauchli
Currie. Mr. Vasey's work involves a review o
functions of the Treasury Department and th
Comptroller General with a view to developin
recommendations for a revised plan of operation
and an efficient organization. It was anticipate
that Mr. Vasey's experience with the Bureau o
Reclamation and previously with the Bureau o
the Budget would be of considerable value in han
dling this unusual assignment. ●

RIO NEGRO dam and power plant in Uruguay, an outstanding example of durable concrete construction and modern engineering.

LA PAZ, Bolivia. Arrow points to Franklin D. Roosevelt Par
named in honor of the late president of the United States.



GETTING ACQUAINTED with reclamation projects and people, the author (inset) a Nebraska water resources advocate, made and planned this trip from June to December to learn of water users' interests and problems.

NEEDED—MUNICIPAL WATER

by MERL B. PEEK, Assistant Secretary-Manager, National Reclamation Association

A visitor in the Great Northern Hotel at Devil's Lake, N. Dak., is immediately impressed with a sign posted in all rooms which warns its readers that water is scarce. It reads: Tap water, call room service, and drinking water will be delivered to you.

No wonder the people around Devil's Lake support the plan for the Missouri-Souris division, Missouri Basin project. Under this plan Sheyenne River waters will be diverted into the Devil's Lake Basin to replenish those lake waters which have been receding for the past 40 years. This new water will provide the Devil's Lake community with an unfailing source of municipal supply.

Similar municipal water-supply conditions prevail in many Western communities. People who are fortunate enough to be near a reclamation project have high hopes for ultimate relief through storage and canal facilities provided by the project. This demonstrates that municipal water supply is fast becoming a full-fledged partner with irrigation and power development in our present and future multiple-purpose projects.

The Collbran project, which will soon be before Congress for authorization, gives great promise to the residents of Grand Junction, Colo., for further population and industrial growth. However, before the city residents can enjoy project water, they must spend a substantial sum of money for an equalizing reservoir and a water-treatment plant. Too, they must contract for repayment with the Federal Government for the capital project costs allocated to municipal waters. The present plan calls for repayment in 60 years at 2 percent interest on that portion of the capital investment which is allocated to municipal water.

The residents of Pueblo, Colorado Springs, and other communities in the Arkansas River Valley are desperately in need of additional sources for municipal water. For that reason, and because of the opportunity for supplemental water for their already developed agricultural lands in the valley, great interest is shown in the first phase of the

ALTUS DAM—one of the Bureau of Reclamation projects which supplies municipal water. ***Photo by P. W. George, Region 5.***

Gunnison-Arkansas project, commonly known as the Frying-Pan Diversion. The project plan will soon be ready for action by Congress.

Some 11 west Texas communities, including Amarillo and Lubbock, have found a solution for their critical municipal water needs in that booming defense area by the recent Congressional authorization of the Canadian River project. (See page 48 of this issue.) A statutory limitation on the amount of revenue bonds which Texas municipalities can issue forced these communities to turn to the Federal Government for financial aid. The greater portion of the estimated $85,000,000 costs will be repaid with interest over a 50-year period.

The proposed Anadarko (formerly the Fort Cobb) project in Oklahoma could furnish municipal water supply to the communities of Anadarko and Chickasha, Okla. The cost of delivering water to these two communities is estimated to be about 12 cents per thousand gallons. This revenue will permit repayment to the Federal Government of the entire capital costs allocated to municipal water supply in 50 years at 2 percent interest.

Rapid City, S. Dak., after a population growth of almost 100 percent to 26,000 persons in the past decade, is busy casting about for an additional municipal water source. Deerfield Reservoir, Rapid Valley project, located on Castle Creek about 27 miles west of Rapid City with its 15,700 acre-feet storage capacity is insufficient for the present City needs. The irrigation demands of some acres of land downstream in Rapid Valley for a portion of this storage further complicates the municipal water-supply problem. Steady pumping from city artesian wells has lowered the water level in an adjoining lake used by the State for a fish hatchery. The people in the project area commented very favorably on the proposed Pactola Reservoir as supplemental storage to relieve this situation which is rapidly becoming critical.

Residents of Belle Fourche, S. Dak., expressed their keen interest in the Wyoming-located Keyhole Dam and Reservoir on the Belle Fourche River as a water source to further the industrial expansion of their community.

Lemmon, S. Dak., city officials are busily engaged in negotiating with the Bureau of Reclamation officials for additional municipal water from the Shadehill Reservoir, on nearby Grand River. Several unavailing attempts to find new pumping sources for needed water have greatly discouraged the residents of this community.

People in Dickinson, N. Dak., mentioned with great satisfaction the rapidly filling reservoir behind the recently completed Dickinson Dam. The function of this storage is almost entirely dedicated to serving the municipal needs of this nearby community.

Under the proposed plan of development for the Missouri-Souris Division, diverted waters below Fort Peck Dam on the Missouri River would flow into the Souris Canal in northwestern North Dakota for the irrigation of over 1 million acres of lands. Municipalities located near the canal are counting on being supplied with water for municipal and industrial purposes.

Discouraging reports on the subsurface drainage aspects of the potentially irrigable lands in northwestern North Dakota, in the Crosby-Mohall area of the Missouri-Souris Division, have had an adverse effect on the communities located therein. Mayor C. S. Summers of Bowbells concisely stated the case by saying "our town has been short of a municipal water supply for more than 30 years." Many other commmities in the Crosby-Mohall area are in a similar situation.

City officials in Tucumcari, N. Mex., are considering plans to participate in the use of stored waters behind Conchas Dam on the South Fork of the Canadian River. Altus, Okla., is receiving municipal water from the overflowing (summer, 1950) Altus Dam, W. C. Austin project, Okla.

The very existence of persons living in such Western metropolitan centers as Salt Lake City and Ogden, Utah; Phoenix, Ariz., San Diego and

Los Angeles, Calif., and El Paso, Tex., depends on Reclamation project water.

Historically, the Bureau of Reclamation was first authorized to supply water for municipal purposes by the Town Site Act 1906. Broader authority was granted the Bureau in the Miscellaneous Water Act, 1920. The Reclamation Project Act, 1939, also authorizes the Secretary of Interior to furnish water for municipal and industrial purposes either as a part of multiple-purpose projects or as single-purpose projects. The people need municipal water. THE END.

George S. Knapp Succeeded by Robert V. Smrha

Robert V. Smrha, new chief engineer of the Division of Water Resources, Kansas State Board of Agriculture (at left), with George S. Knapp, his illustrious predecessor. *Photo by Glenn S. Thomas, Office Engineer, Cedar Bluff Unit, Ellis, Kans.*

George S. Knapp, chief engineer of the division of water resources, Kansas State Board of Agriculture, and long an ardent reclamationist in that State, resigned on January 1, 1951.

During his long tenure of office with the board, dating back to 1919, he gained national recognition as an authority on water-resource development and served as executive secretary of the President's Northern Great Plains Committee during the drought of the 1930's. He served as secretary of the Missouri River States Committee since its organization and was the man most instrumental along with Senator Frank Carlson in inducing former Commissioner John C. Page to begin Reclamation investigations in Kansas.

Mr. Smrha (pronounced Smur–uh with accent on the first syllable) has been in the division since 1930, and senior engineer since 1937. •

Bureau to Build Transmission Lines in South Dakota

Acting Commissioner of Reclamation Goodrich W. Lineweaver recently announced the award of contracts for the construction of a 520-mile transmission line grid in eastern South Dakota. Work on the lines is expected to begin immediately.

A similar advance construction program is already under way in North Dakota.

The transmission system will distribute low cost power which will be generated at plants in the Missouri River Basin. Ultimately more than 2,000,000 kilowatts of capacity will be required for the farms, communities, and industries of the region. Every effort is being made to step up construction of the system to meet emergency defense and other demands in power-short areas of the West.

Denver, Colo., contractors C. F. Lytle & Co. and R. N. Campsey Construction Co., and the Dallas, Texas B. & C. Construction Co. were awarded the contracts to build the 53 miles of 115-kilovolt transmission lines from Brookings to Watertown; 77 miles from Watertown to Groton and 90 miles from Groton to Huron.

The Orlando Construction Co. of Coleman, Wis., will construct 58 miles from Sioux Falls to Brookings, and 68 miles from Armour to a point near Fort Randall switchyard site and then to Gavins Point.

Approximately 84 miles from Huron to Armour and 89 miles from Gavins Point to Sioux Falls will be constructed by the Flora Construction Co. and Flora Engineering Co. of Denver, Colo.

The construction contract awards were made 15 days after the East River Electric Power Cooperative executed the contract with the Government for the power for distribution to its member cooperatives. (For earlier story see RECLAMATION ERA.—December 1950, p. 205.) •

Sequim Project Dropped

As the result of a public hearing held on August 11, 1950, in Sequim, Wash., during which a preponderance of local opposition to the project was displayed, the Bureau of Reclamation is discontinuing investigative work on the potential 19,000-acre Sequim irrigation development near Port Angeles, Wash. •

Wade H. Taylor Becomes Region 3 Power Director

Wade H. Taylor, who succeeds Roy V. Sprague as regional director of power in Region 3, will supervise all technical phases of the Reclamation hydroelectric program in the lower Colorado River Basin.

Mr. Sprague retired last July 1, at which time Mr. Taylor was assistant regional power manager. As a member of Regional Director E. A. Moritz's staff, Mr. Taylor will also head the branch of power utilization in the region. This branch has technical supervision over Bureau operations at Hoover, Davis, and Parker power plants and their integrated transmission systems in California, Arizona, and Nevada.

Mr. Taylor received his master of science degree in electrical engineering at Purdue University. He joined the Bureau of Reclamation in 1935 as junior engineer and has rapidly advanced through the ranks, becoming assistant regional power manager of Region 3 in 1945. •

All Eyes on Wind River

(Continued from page 52)

willow tree "spiders" were placed in the most critical stream bank erosion areas. Approximately 75 percent of the plantings have survived. Five sets of experimental seeding plots, including 21 species of various grasses and legume seeds, were planted under various conditions of elevation, site, soil, and moisture. The Bureau of Indian Affairs has conducted its experimental work on Five Mile Creek above the Riverton project where stream-bank erosion is aggravated only by natural flow. In a 1-mile strip various practices have been tested including fencing for livestock exclusion, bank sloping, tree planting, grass seeding, and the installation of live willow "spiders." All of these practices, either separately, or in combination, appear to be effective. The Bureau of Reclamation assignment was to make plantings on Five Mile Creek within the Riverton project where stream bank erosion has been severely accelerated by both normal flood flow and return flow from the irrigated project. A 1-mile section of the channel was selected where live cable trees, large willow "spiders" and tetrahedrons were installed. These practices were supplemented by planting willow and Russian Olive trees and seeding of sweet clover. The entire area was fenced to exclude livestock.

Investigating further methods of stream bank erosion control, the Geological Survey and the Bureau of Reclamation have mapped the bedrock exposures along the channels of both Five Miles and Muddy Creeks from their mouths to above the irrigated lands. This study has focused attention on the natural stabilization of the channel walls in the reaches where bedrock is exposed in contrast to rapid bank cutting where bedrock is absent. This information is now being supplemented by drilling where the bedrock is not exposed, and by obtaining center line profiles and cross sections of both streams. These three surveys will furnish the necessary background and investigations toward channeling the creeks to take advantage of bedrock locations.

To investigate the relative importance of soil losses from the range, studies are under way that will provide basic information as to the rate of erosion and soil losses from typical range areas under varying degrees of use and conditions. They will serve as a guide in carrying on future soil conservation and range-management programs.

The Geological Survey has a topographic mapping project under way that will eventually cover the entire basin. The basic and supplemental control has been completed, and preliminary maps are now available for the Riverton and Kinnear quadrangles.

The irrigation history and irrigation plans have been developed cooperatively by the Bureau of Reclamation and the Bureau of Indian Affairs. In this cooperative venture the Bureau of Reclamation is making the land classification, investigating storage facilities, and making the water-supply studies in cooperation with the Bureau of Indian Affairs. Canal, lateral, and appurtenant works investigations and tabulating information available on Indian irrigation developments are being done by the Bureau of Indian Affairs.

Ground-water and range-water development surveys are being conducted by the Geological Survey.

The Bureau of Reclamation is computing the total amount of soil which has been eroded from

WORLD LEADERS OF IRRIGATION AND HYDROELECTRIC DEVELOPMENT MEET IN INDIA

STERN CONGRESS—United States Commissioner of Reclamation chael W. Straus, speaking at the opening of the World Irrigation hibition at New Delhi, India, on January 10, in connection with Fourth Congress on Large Dams, the World Power Conference d the First Congress on Irrigation and Canals, attended by over thousand delegates from 30 nations. Listening attentively are (from left to right) Sir Vincent de Ferranti of Great Britain, chairman of the International Executive Council of the World Power Conference; Monsieur Andre Coyne of France, President of the International Commission on Large Dams; and Shri N. V. Gadgil, India's Minister of Works, Mines, and Power. ***Photo through the courtesy of the Punjab Photo Service of New Delhi, India.***

e main channels of Five Mile and Muddy Creeks rough the Riverton project, and has completed ork on Five Mile Creek.

Preliminary economic surveys have been under ay since the start of the Wind River investigations. The studies in progress show the relationip between the full and orderly development id utilization of land, water, mineral, forest, and man resources of the basin and its economic owth, which is the ultimate goal of the various velopment programs in the basin.

The Fish and Wildlife Service's contribution is been to investigate the fish and wildlife reurces of the basin. Work to date has included vestigations and reports in Bureau of Reclamaon projects operating and proposed, Indian servation wildlife inventory and production surys, and comprehensive studies on lands of the ational Forest, Bureau of Land Management, id private holdings.

The National Park Service and the Smithsoan Institution have conducted surveys and instigations to determine and appraise recreaonal, scientific, and history values of the basin. They will continue to study the effects of the Bureau of Reclamation project construction upon values and make recommendations concerning the conservation, use, and development of the basin's recreational, scientific, and historic resources.

The various agencies which have cooperated so wholeheartedly in making the Wind River Basin investigations a reality have accomplished during the past 2 years what was expected to take at least 5, and possibly 10 years. Many jobs remain to be completed, but the field committee now considers that within the next year to 18 months enough data will be available so that the complete plan for total basin conservation will begin to emerge. One of the last official acts of W. G. Sloan, retiring Chairman of the Interior Field Committee, was to reactivate a subcommittee to draft the final conservation report for the Wind River Basin. Members of this committee are: K. R. Melin, Department of Interior, chairman; Charles T. Hinze, Bureau of Reclamation; W. T. Vaughn, Bureau of Land Management; John M. Cooper, Bureau of Indian Affairs; and Thomas F. Hanley, Geological Survey. THE END.

WATER REPORT

By the first of February, Reclamation's water supply situation had not changed greatly since January. Reservoirs on most of the projects stored as much water as they usually do this time of year, with a few scattered exceptions, notably in the Southwest. Some of the reservoirs in the Columbia Basin and in western Nevada were releasing water to make room for spring floods. Runoff from the upper Colorado Basin was lower than usual for January, and Lake Mead was slightly below its normal level. The snow cover in the Great Basin was spotty. No relief from drought for the Salt River project and the Rio Grande. Missouri Basin reservoirs were at favorable seasonal levels, and no shortage of irrigation water was anticipated.

Here are the highlights of the water storage situation by regions (see map on back cover to locate areas):

REGION 1—Except for Oregon's Vale project, the reservoirs were storing enough water to take care of next year's irrigation. At Vale, although more than the usual amount of water flowed into the reservoir during the month, it was not enough to make up for last season's low hold-over. Vale project farmers had a poor prospect for abundant storage. On the other hand, the Anderson Ranch reservoir held nearly 300,000 acre-feet by the end of January—nearly as much as it contained at the end of the spring runoff last year.

REGION 2—Abundance was the word as of the first of February for all projects, including the Central Valley. Shasta Lake's inflow from October 1, 1950, to January 31, 1951, was 108 percent of the maximum record; Lake Millerton, 167 percent of the maximum. Irrigation farmers in the Sacramento Valley and on lands served by the Delta-Mendota canal should have abundant irrigation water to mature their crops. Only the lack of distribution systems limited the use of the abundant water supply on the lands served by the Friant-Kern and Madera canals.

REGION 3—Drought continued in Arizona, and there was very little snow cover in the high mountain areas. The Salt River was a mere trickle into Roosevelt Reservoir, reaching a record low for the fifth time in 6 months. The lands were very dry, and farmers must continue pumping water from wells. Lake Mead continued to have a large hold-over, and project farmers depending upon its supply had no worry about this year's irrigation season.

REGION 4—Water supplies ranged from fair to excellent. Very light snowfall probably means a "fair" forecast for Colorado's Mancos and Pine River projects. Prospects for Nevada's Newlands project and Utah's Weber River project were excellent. However, as on the Uncompahgre project, in Colorado, where heavy snowfalls on the watershed during the latter part of January changed conditions from very dry to about normal, a heavy spring snow could materially change the outlook. Dry soils in the valley and on mountain pastures may absorb much of the present moisture without affording much runoff, but should not affect the runoff from snow above the timberline.

REGION 5—The Rio Grande project continued to be drought-stricken. W. C. Austin's Altus Reservoir was almost full, with enough irrigation water for this year's crops. This project had a dry fall and winter, and there is a demand for water delivery early in February for wheat and preirrigation of potato land. Except for the Rio Grande project (where no stored water was released for irrigation during the whole month of January, and Elephant Butte Reservoir had the lowest January storage since 1919) all other projects within the region should have sufficient irrigation water for this year's crops.

REGION 6—and REGION 7—In both the upper and lower Missouri Basin the reservoirs contained satisfactory seasonal storage. Snow cover on the North and South Platte watersheds was above normal. In the valley areas, however, precipitation had been deficient for several months and soil moisture conditions were fair to poor. ●

CROPS

14,000,000 Tons of Food Produced on Reclamation Projects

In 1950 Reclamation projects scored the second highest record for production of food, forage, and fiber crops in its history—almost 14,000,000 tons. Total value of the year's production, which will go far toward meeting the needs of national defense and sup- menting the world food supply, ceeded a half billion dollars.

This marks the eighth straight Reclamation crops have excee 10,000,000 tons and brings the production since 1943 to 102,000 tons.

Since 1906 when water was delive to the first Reclamation project, i estimated that 250 to 300 million of fruits, vegetables, cotton, su beets, feed and forage for livest have been produced on all projects.

Secretary of the Interior Oscar Chapman, discussing Reclamati crop record, said, "the record of c production from federally irriga lands is a striking example of the portant contribution made by Fed reclamation to the food supply of world and to the buying power of Nation." ●

LETTERS

Idea Exchange

DECEMBER 5, 195

DEAR EDITOR: You have asked fo and as far as one interested reader the November issue of RECLAMAT ERA can go, you are going to get it.

Please enroll me at once as an respondent to your news offer. wife and I are long-time owners of acres of raw land lying under Coachella Canal between Indio and Quinta, Calif., a part of the Bou Canyon Reclamation project. T acreage in the northwest corner of tion 10–6S–7E, is classed as prime ea vegetable, grapefruit and date gar land, and it is our intent to develop after the best advice and plans that can obtain, a sort of model, push-but farm. Hence, your invitation f upon most fertile soil.

The article by D. L. Brechner of Columbia Basin project, entitled "R ing Laterals," appearing in the curr issue of ERA, caught my eye as a v typical example of helpful contribut to reclamation success even thoug concerns a problem materially diffe from ours.

Obviously, we would be most a by articles or bibliographies on phases of desert land developing, ginning with the raw land and lead through the phases of clearing, le ing, irrigating and soil-building riptions of actual methods that exence in such areas as the Coachella ley, has proven best.

he phrase in Mr. Brechner's article, redesign the manufacturers can ect this weakness when it appears," s to a picture of widespread coopion through your yet unnamed mn that might prove of great interind mutual benefit to both manufacr and farmer. Ideas, good ideas, e a way of appearing to people at times and under a variety of cirstances.

hey may appear to career farmers, designers in farm implement faces or even to retired professional neer-farmers such as I look ford to being in a few years. Amer- ingenuity has always been espey active in creating labor-saving ces. Would it not be well within purview of your contemplated fea- to act as a national thought exge to encourage original ideas of labor saving, family comfort, land rovement, crop betterment, and marng problems?

such a field is within your scope, ne suggest a proposed feature that ht readily be tested among your lers as to its value and breadth ppeal. I have in mind the many el, and sometimes valuable, ideas belong, under our patent and copyt laws, to the originator but which, ugh lack of a medium to appraise publish such discoveries, frequently lost sight of or fall into hands which oit the discoverer and the group to ch he belongs.

any of such ideas are developed and into use by farmers who are motid by no interest other than to imve their own lot and that of their hbors. They are neither equipped do they desire to exploit a patent copyright as such.

hat do you think about the value to Nation of a service to farmers and nds of the Reclamation Service that ld consist of checking with the ent Office such ideas as would con- agronomy in arid areas to the end originators could protect themes and their group against lost or loited ideas by dedicating patent its and copyrights to a sort of naal foundation or trust created for purpose and by publication in your mn, spread the ideas among those may find them useful and, at the same time, protect them from outside appropriation and exploitation.

An additional incentive might easily be created through an annual award of a cup or medal by the President or some other high dignitary, together with several honorable mentions, to those who as a result of a poll among your readers, are deemed to have contributed the most to the welfare of reclamation communities.

Farmers are becoming increasingly mechanically minded and skilled, and are able to fashion many gadgets in a most economical manner. Manufacturers, too, would generally profit from a greater utilization of mechanical devices in raising the standards of American farm life through this tapping of a reservoir of original ideas.

As for your feature's name, it should bring to mind the good that may come to many through united effort, united thought—it must be short, significant, inspirational. Shall it denote the principle, or the process or the effect? "Think United" is an example of the first, "Seek and Share" is a process, "E pluribus bonum" might be a result, but distracting?

I recommend "Seek and Share" as being action and cooperative, akin to the Golden Rule.

Sincerely contributed,

L. Plitt Smeltzer,
4828 Glencairn Road
Los Angeles 27, Calif.

The Smeltzer suggestions are most welcome, and we hope our readers will comment and send in their ideas. We particularly like his idea of a national foundation or trust to ferret out patents and inventions of aid to irrigation farmers, and exchange the information among those concerned. The Era *will do its part, but this appears to be something which could be handled to great advantage by private, rather than public, agencies. The patent laws are designed to protect "lost or exploited ideas," and within our province, we plan to follow Mr. Smeltzer's suggestion by publishing descriptions of patented inventions which might be of value to irrigation farmers. The Patent Office publishes "The Patent Quarterly" which summarizes all items on which patents have been issued, and any of our readers who would be interested in developing Mr. Smeltzer's idea, with its ramifications of a Presidential award and stimulating manufacture of useful inventions, have our best wishes. Let us hear from more of our readers.—Ed.*

POSTSCRIPTS

How Nature Created Fertilizers

The story of creation was told in a very few words. And in somewhat similar, concise fashion Dr. Firman E. Bear of Rutgers University relates the earth's history, as seen by a soil scientist, in just two paragraphs:

"The earth came into existence some 2 billion years ago. A billion years passed before even the simplest forms of life came into being, and it took another 700 million years for flowering plants to evolve. The primitive forms of man did not arrive on the scene until a mere million years ago.

"During the 2 billion years of the earth's existence, gigantic forces were at work tearing the rock to pieces, leaching out the soluble salts, carrying them out to sea, and laying down large deposits of them on the bottoms of the oceans. In addition, atmospheric nitrogen was being combined with carbon, hydrogen, and oxygen on a tremendous scale to form organic matter."

As Dr. Bear points out, this great leaching process was not as wasteful as it might sound. Perhaps there was method in nature's seeming madness because large quantities of these rock-derived materials were shoved up out of the oceans through earthquakes and other natural forces. Such deposits, including many billions of tons of phosphate rock, potash salts, nitrate of soda, limestone, sulphur, and borax, are now being mined and put back on the land in the form of commercial fertilizer. Nitrogen is also being taken from the air, combined with other elements and used to enrich the land.

Were it not for these tremendous natural reserves of minerals and their availability for use as fertilizers, the future task of producing food for the earth's increasing population would be an almost hopeless one. Even in Montana and Wyoming, where soils are relatively rich in most of the elements that are essential for crop production, there is increasing use of fertilizers year after year, particularly on irrigated land. (*From July 1, 1950 issue of the Montana Farmer-Stockman, p. 7.*)

NOTES FOR CONTRACTORS

Contracts Awarded During January 1951

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Con[tract] amo[unt]
DC-3204	Central Valley, Calif.	Jan. 11	Furnishing and installing three 60,000-kilovolt-ampere vertical-shaft generators for Folsom power plant.	Westinghouse Electric Corp., Denver, Colo.	$2,55
DS-3226	Rio Grande, N. Mex.	Jan. 16	1 46,000-volt circuit breaker for Albuquerque substation, schedule 2.	do.	10
DS-3230	Minidoka, Idaho	Jan. 18	1 spare turbine runner for units 1 to 4, Minidoka power plant.	Allis-Chalmers Manufacturing Co., Denver, Colo.	1
DC-3231	Columbia Basin, Wash.	Jan. 16	Miscellaneous architectural finishes for right and left control bay, power plant, and elevator towers at Grand Coulee Dam.	A. Ruud, Spokane, Wash.	6
DC-3235	do.	Jan. 19	Construction of West Canal-Frenchman Hills tunnel.	United Concrete Pipe Corp. and Ralph A. Bell, Baldwin Park, Calif.	2,17
DC-3236	Central Valley, Calif.	Jan. 9	Construction of earthwork, pipelines, and structures for lateral 93.2W and lateral 93.2E, and sublaterals, Lindmore irrigation district, Friant-Kern Canal distribution system.	Steve P. Rados, Inc., Los Angeles, Calif.	66
DS-3239	Colorado-Big Thompson, Colo.	Jan. 3	4 3- by 3-foot outlet gates with 4 hydraulic hoists and six conduit liners for Carter Lake Reservoir.	Willamette Iron & Steel Co., Portland, Oreg.	3
DC-3243	Missouri River Basin, S. Dak.	Jan. 12	Construction of 127 miles of Sioux Falls-Brookings and Armour-Fort Randall-Gavins Point 115-kilovolt transmission lines, schedules 1 and 3.	Orlando Construction Co., Coleman, Wis.	93
DC-3243	do.	do.	Construction of 173 miles of Huron-Armour and Gavins Point-Sioux Falls 115-kilovolt transmission lines, schedules 2 and 4.	Flora Construction Corp., and Flora Engineering Co., Denver, Colo.	1,33
DC-3244	Colorado-Big Thompson, Colo.	Jan. 5	Construction of earthwork, concrete canal lining, and structures for Poudre supply canal, Windsor section.	Paul G. Van Sickle Corp., Denver, Colo.	23
DC-3246	Missouri River Basin, S. Dak.	Jan. 10	Construction of 220 miles of Brookings-Watertown-Groton-Huron 115-kilovolt transmission line.	C. F. Lytle Co., R. N. Campsey Construction Co., and B & C Construction Co., Denver, Colo.	1,86
DC-3249	Rio Grande, N. Mex.-Tex.	Jan. 4	Construction of Luecro Arroyo dike, wasteway channel, and structures.	Lee Moor Contracting Co., El Paso, Tex.	4
DS-3250	Hungry Horse, Mont.	Jan. 20	Fabricated structural steel for take-off structure at Hungry Horse power plant.	Virginia Bridge Co., Denver, Colo.	2
DS-3253	Boulder Canyon, Ariz.-Nev.	Jan. 9	1 lifting beam and 1 jacking frame for unit A9, Hoover power plant.	Star Iron & Steel Co., Tacoma, Wash.	1
DS-3255	Missouri River Basin, Wyo.	Jan. 16	1 12- by 15-foot ½-inch bulkhead, 3 6-foot 9-inch by 10-foot 2⅛-inch bulkhead gates, 1 lifting beam, 2 bulkhead frames, and 6 bulkhead gate frames for Boysen power plant.	Southwest Welding & Manufacturing Co., Alhambra, Calif.	2
DS-3262	Hungry Horse, Mont.	Jan. 22	Fabricated structural steel for 230-kilovolt switchyard and transformer circuits for Hungry Horse power plant.	B. Katchen Iron Works, Inc., Newark, N. J.	3
DS-3264	Columbia Basin, Wash.	Jan. 30	16,000 barrels of bulk portland cement for construction work in vicinity of Grand Coulee Dam, schedule 2.	Spokane Portland Cement Co., Spokane, Wash.	6
DC-3267	Missouri River Basin, Wyo.	Jan. 31	Construction of 84 miles of Thermopolis-Lovell 115-kilovolt transmission line and 18.6 miles of Garland-Lovell 69-kilovolt transmission line.	J & J Construction Co., Oklahoma City, Okla.	84
DS-3270	Eklutna, Alaska	Jan. 26	One 3,000 kilovolt-ampere package-type substation for Palmer substation.	General Electric Co., Denver, Colo.	3
100S-109	Minidoka, Idaho	Jan. 4	Seven 2,300-volt motor control units for pumping units at wells, North Side Pumping Division.	Afton-Lemp Electric Co., Boise, Idaho.	2
117C-86	Columbia Basin, Wash.	Jan. 5	Construction of permanent residences, utility building garages, driveways, and utilities at O. & M. sites, schedule 1.	Westover and Hope, Quincy, Wash.	1
117C-86	do.	Jan. 3	Construction of permanent residences, utility building, garages, driveways and utilities at O. & M. sites, schedule 2.	Commercial Builders, Inc., Moscow, Idaho.	1
117C-86	do.	Jan. 3	Construction of permanent residences, utility building garages, driveways, and utilities at O. & M. sites, schedules 3, 4, 5, 6, 7, and 8.	Dale R. Peterson and Co., Inc., Seattle, Wash.	13
100C-113	Boise, Idaho	Jan. 25	Construction of East Hartley Gulch drain, Payette Division.	James S. Trummell, Nyssa, Oreg.	4
200C-137	Central Valley, Calif.	Jan. 8	Three-bedroom residences, Friant-Kern Canal, schedule 3.	Dan E. Nelson, Fresno, Calif.	2
200C-135A	Orland, Calif.	Jan. 10	Lining portions of North and South Canals.	Berlinger Corp., Chico, Calif.	3
R2-127A	Central Valley, Calif.	Jan. 8	Completion of electrical lighting installations at Shasta Dam.	Vincent Electric Motor Co., Oakland, Calif.	2
R3-PX-52	Davis Dam, Ariz.-Nev.	Jan. 8	Construction of operators' houses at Coolidge, Mesa, and Tucson substations, schedule 1A.	Mardian Construction Co., Phoenix, Ariz.	18
R3-PX-52	do.	Jan. 4	Construction of operators' houses at Coolidge, Mesa, and Tucson substations, schedule 2.	Merle R. Gillespie, Casa Grande, Ariz.	1
300C-10	do.	Jan. 19	Erecting a 75,000-gallon elevated tank at O. & M. system area.	Pittsburgh-Des Moines Steel Co., Santa Clara, Calif.	3
300C-14	Boulder Canyon, Ariz.-Nev.-Calif.	Jan. 19	Alterations and additions to the water treatment plant at Boulder City, Nev.	Drainage Construction Co. and James H. Huntley, Los Angeles, Calif.	13
600C-51	Missouri River Basin, Wyo.	Jan. 4	Clearing part of Boysen Reservoir site, schedule 4.	Lindquist, Olsen & Co., Cambridge, Minn.	9
600C-52	do.	Jan. 19	Clearing part of Boysen Reservoir site, schedule 1.	Asbell Bros. Construction, Riverton, Wyo.	10
600C-52	do.	Jan. 19	Clearing part of Boysen Reservoir site, schedule 5.	Lichty, Brasel & Whitehead, Riverton, Wyo.	7
600C-52	do.	Jan. 22	Clearing part of Boysen Reservoir site, schedule 4.	Watkins & Pennington, Fort Collins, Colo.	9

Construction and Materials for Which Bids Will Be Requested by May 1951

Project	Description of work or material
ler Canyon, Ariz.-7.	Construction of steel frame warehouse, 9,600 square feet in area, at Boulder City, Nev.
uma, Calif.	Construction of 75-foot high, 100,000-cubic-yard earthfill Glen Anne Dam on the West Fork of Glen Anne Canyon, 4 miles northwest of Goleta, Calif.
al Valley, Calif.	10 motor-control switchgear and distribution switchboard units for Southern San Joaquin municipal utility district No. 3.
Do.	Motor-control switchgear for 2,300-volt synchronous and induction motors for Trauger pumping plant.
Do.	1 112.5-kilovolt-ampere distribution transformer for Trauger pumping plant.
Do.	6 vertical-shaft, propeller-type pumping units, each of 33.3 cubic-foot-per-second capacity, for pumping plant No. 1; and 3 pumping units, each of 10 cubic-foot-per-second capacity, for pumping plant No. 2, Columbia-Mowry canal.
Do.	Three 60,000-kilovolt-ampere transformers for Folsom power plant.
Do.	4 vertical-shaft, turbine-type pumping units, 2 of 7 cubic-foot-per-second capacity and 2 of 3.5 cubic-foot-per-second capacity, for Exeter irrigation district pumping plant.
Do.	6 potential transformers for Tracy switchyard.
ado-Big Thompson, lo.	Construction of 90-foot high, 285,000-cubic-yard earthfill Rattlesnake Dam, 14 miles west of Loveland, Colo.
Do.	Furnishing and laying 2,100-foot Pole Hill penstock, 2 5,850-foot Flatiron power plant penstocks, and 1,350-foot Carter Lake pressure conduit (Flatiron pumping plant discharge conduit).
Do.	Main control board, supervisory control board, annunciator relay cabinet, distribution boards, battery-charging equipment, and station service transformers for Pole Hill power plant.
Do.	Generator voltage bus structure and circuit breaker for Pole Hill power plant.
Do.	Construction of Flatiron section of Horsetooth feeder canal, including 3.5 miles of concrete-lined canal, a 700-foot tunnel, and 2 500-foot siphons, 10 miles west of Loveland, Colo.
Do.	1 13,000-horsepower synchronous motor for Flatiron power and pumping plant.
Do.	Main control board, supervisory control board, and annunciator relay cabinet for Flatiron power and pumping plant.
Do.	Motor-control boards, distribution boards, heating control boards, battery charging equipment, and station service transformers for Flatiron power and pumping plant.
Do.	8 115-kilovolt disconnecting switches without grounding blades, 5 115-kilovolt disconnecting switches with grounding blades, and 1 115-kilovolt power circuit breaker for Flatiron switchyard.
Do.	Construction of 400-cubic-foot-per-second capacity Willow Creek pumping plant, 2 miles of Willow Creek pump canal, and 7,500-kilovolt-amperes Willow Creek switchyard, 4 miles north of Granby, Colo.
Do.	2 5,000-horsepower synchronous motors for Willow Creek pumping plant.
Do.	69-kilovolt line panels, 480-volt station service unit substation, and supervisory control equipment for controlling Willow Creek pumping plant from Granby pumping plant.
Do.	1 10,000-kilovolt-ampere and 1 500-kilovolt-ampere power transformer, 2 115-kilovolt, 600-ampere disconnecting switches, and 3 current and 3 potential transformers for Willow Creek switchyard.
Do.	Construction of a concrete diversion dam and 12.4 miles of North Poudre supply canal extending northeast from the Cache la Poudre River, 18 miles northwest of Fort Collins, Colo.
Do.	Main control board for Beaver Creek substation.
mbia Basin, Wash.	Construction of 91 miles of laterals ranging from 2 to 300 cubic-foot-per-second capacity to irrigate 20,000 acres in lateral area E-3 on East Low canal, 8 miles southeast of Moses Lake, Wash.
Do.	Construction of 15.5 miles of 1,800-cubic-foot-per-second capacity unlined Potholes East canal and 5 miles of 1,800-cubic-feet-per-second capacity unlined Ringold wasteway, 6 miles southeast of Othello, Wash.
Do.	Construction of a guard and fire house headquarters building for the city government of Coulee Dam, Wash.
Do.	Grading streets, parking area, sidewalks, and lots; paving streets and parking area; constructing sidewalks, curbs, and storm-drainage facilities; installing street-lighting cable; relocating medical office building; and removing 13 buildings in Coulee Dam, Wash.
Columbia Basin, Wash.	Construction of a 50- by 100-foot general purpose shop at Quincy, Wash.
Do.	Construction of a building for housing radio receiving and transmitting equipment at Ephrata, Wash., and radio-equipment buildings at Quincy and Othello, Wash.
Davis Dam, Ariz.-Nev.	Completion of architectural finish work and miscellaneous installations of equipment in Davis power plant, transformer deck and spillway structures.
Do.	Construction of concrete spillway stilling basin at Davis Dam.
Do.	Erecting steel structures and installing electrical equipment for Cochise substation.
Eklutna, Alaska	Construction of 4.4-mile, 9-foot diameter, concrete-lined Eklutna tunnel and surge tank.
Gila, Ariz.	Construction of 15-mile, concrete-lined, 300 cubic-foot-per-second capacity Wellton canal.
Grand Valley, Colo.	Construction of 3 precast concrete pipe siphons: 1,600 feet of 18-inch diameter pipe, 400 feet of 30-inch diameter pipe, and 4,000 feet of 60-inch diameter pipe.
Kendrick, Wyo.	Construction of 3,750-kilovolt-ampere Rawlins substation.
Do.	Construction of about 30 miles of Sinclair-Hanna 34.5-kilovolt transmission line.
Do.	Furnishing and installing 2 18,950-kilovolt-ampere generators for Alcova power plant.
Do.	2 160-inch turbine butterfly valves for Alcova power plant.
Paonia, Colo.	Construction of 3.4 miles of 170 to 30 cubic-foot-per-second capacity Overland Canal, northwest of Hotchkiss, Colo.
Rio Grande, N. Mex.	Construction of 52 miles of Belen-Willard 115-kilovolt transmission line.
Do.	Construction of 7,500-kilovolt-ampere Willard substation, near Willard, N. Mex., and construction of Belen substation near Belen, N. Mex.
Missouri River Basin, Colo.	Construction of 3,000-kilovolt-ampere Julesburg substation.
Missouri River Basin, Mont.	4 51- by 34.5-foot radial-gate hoists for Canyon Ferry Dam.
Missouri River Basin, Nebr.	Construction of 11 miles of unlined and 2 miles of concrete-lined reaches of 685-cubic-foot-per-second capacity Courtland Canal, 4 miles southeast of Superior, Nebr.
Do.	Construction of 16 miles of 36- to 6-cubic-foot-per-second capacity Courtland laterals.
Missouri River Basin, N. Dak.	Construction of 41 miles of Bismarck-DeVaul 69-kilovolt transmission line.
Do.	Construction of 750-kilovolt-ampere Fort Clark substation.
Do.	Construction of short distribution lines and small substations to serve the Fort Clark pumping plants near Stanton, N. Dak.
Do.	Relocation of 2 miles of county road and raising a county bridge near Dickinson Dam site.
Do.	Supervisory control and selective telemetering equipment for 12 substations controlled from Jamestown substation.
Missouri River Basin, S. Dak.	Approximately 6,300 tons of fabricated galvanized structural steel for bolted-steel towers for Bismarck-Mobridge-Oahe 230-kilovolt, single-circuit transmission line.
Do.	Approximately 11,500 tons of fabricated galvanized structural steel for bolted-steel towers for Oahe-Big Bend-Fort Randall 230-kilovolt, double-circuit transmission line.
Do.	Construction of 30 miles of concrete- and asphalt-membrane-lined reaches of Angostura Canal, 39 miles of laterals and sublaterals, and 21 miles of surface drains, about 10 miles southeast of Hot Springs, S. Dak.
Do.	Construction of 10,000-kilovolt-ampere Woonsocket substation.
Do.	Construction of 3,750-kilovolt-ampere Gregory substation.
Do.	Construction of a camp at Shadehill Dam.
Missouri River Basin, Wyo.	Relocation of about 6 miles of U. S. Highway No. 14 at Keyhole Dam site, about 15 miles northeast of Moorcroft, Wyo.
Do.	Construction of 15,000-kilovolt-ampere Lovell substation.
Do.	Installing equipment in 15,000-kilowatt capacity Boysen power plant, and erecting steel structures and installing equipment for Boysen switchyard, 21 miles south of Thermopolis, Wyo.
Do.	Construction of 6,000-kilovolt-ampere Sinclair substation.
Do.	Construction of 2,000 feet of Alcova switchyard road.
Do.	Grouting contraction joints at Kortes Dam, about 62 miles southwest of Casper, Wyo.

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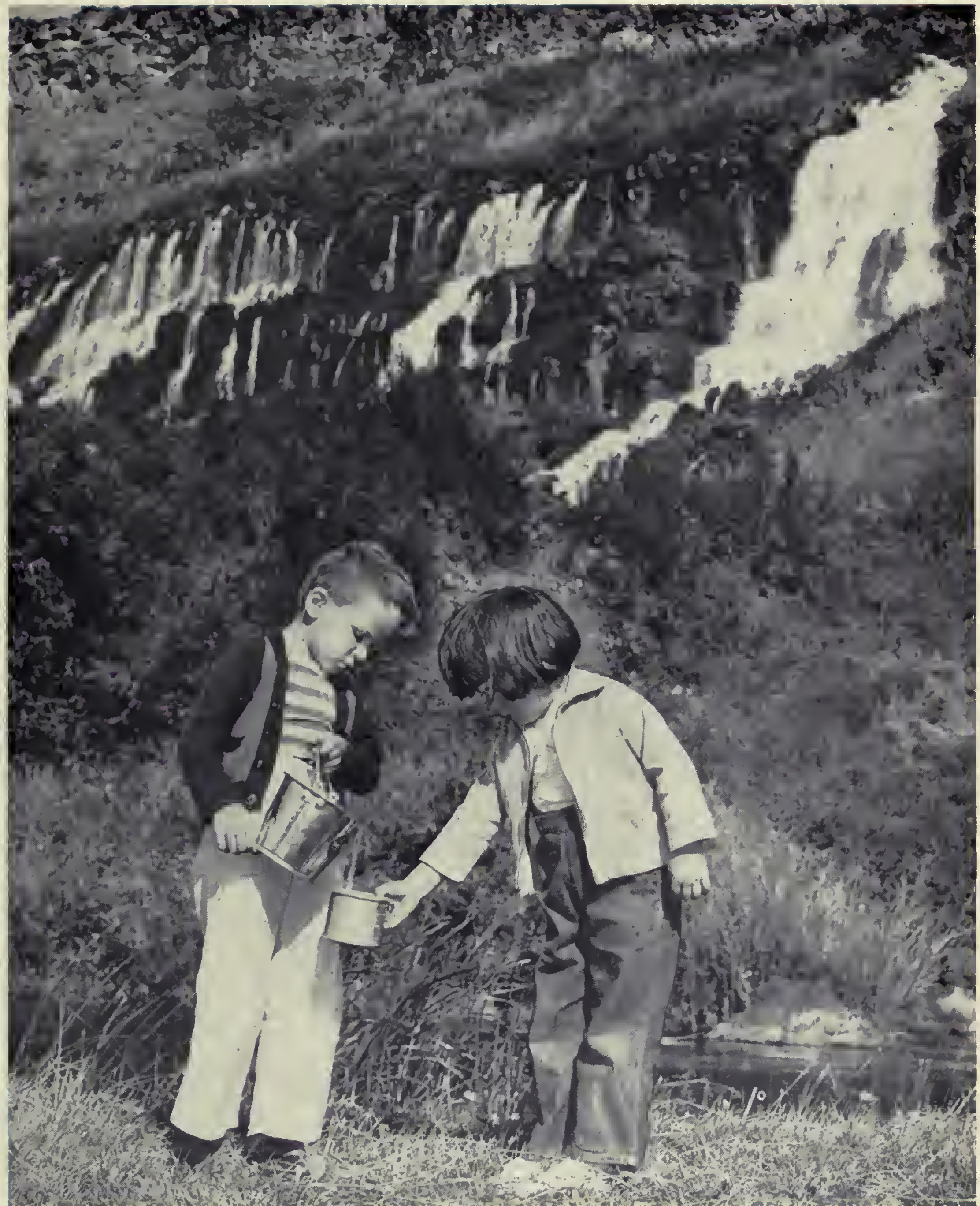
THE RECLAMATION AREA

The Reclamation ERA

April
1951



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SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1 a year for persons residing in the United States and Canada; $1.50 a year for foreign subscriptions; special rate of 50 cents a year for members of water users' associations, and Bureau of Reclamation employees.

OUR FRONT COVER

THIRSTY TOTS Franklin Reese and his sister, Toni Annette, pause for a drink of the crystal clear and cool water from Thousand Springs, Idaho. See story, "Tapping Lost River" on page 66 of this issue. *Photo by Phil Merritt*, Region 1 photographer.

30 YEARS AGO IN THE ERA

The clouds are breaking in the West, spring has co and the farmer is in his fields again, bravely facing future and hopeful that when another harvest time arri his present financial troubles will be alleviated. Recog tion of his problems and methods aimed to put farming an industry on a more stable footing are promised by lawmakers and other agencies which are in position to helpful. Meanwhile there is to be no letup on the part the farmer to produce the food upon which the wo depends.

(From "Current Comments gathered from the Pro Press and People," by C. J. Blanchard, statistician, p 147, April 1921 issue of the RECLAMATION RECORD, pr ecessor of the RECLAMATION ERA.)

RECLAMATION PLACE NAMES IN THIS ISSUE

The following communication from Secretary of the Interior Oscar L. Chapman to Acting Commissioner of Reclamation Goodrich W. Lineweaver on the occasion of the second annual construction engineers conference at Denver, Colo., February 12–16, 1951, is published as an indication of the role which the Bureau of Reclamation's construction staff will perform during the coming year.

UNITED STATES DEPARTMENT OF THE INTERIOR

Office of the Secretary

Washington, D. C.

February 12, 1951.

My Dear Mr. Lineweaver: Please convey to the Conference of Construction Engineers of the Bureau of Reclamation at Denver this week the hearty congratulations of the entire Department of the Interior on the record of achievements they and their predecessors have made to the West, and for the conservation and use of its greatest single natural resource—water. The monuments to their skill and ingenuity range from the great multiple-purpose undertakings down through the single irrigation projects.

On the foundation the construction engineers have erected from the superb designs created under the direction of the Chief Engineer, Reclamation strengthened the Nation for the emergency that is upon us and bulwarked its domestic economy for the long pull. The projects of the 3½ million kilowatts of hydroelectric power now installed in Reclamation plants are serving the Nation today, as will the 7½ million kilowatts when presently authorized installations are completed.

Reclamation power is a bulwark of defense in these perilous times and the multiple-purpose phases of our developments will add further to internal security of the Nation.

Food, forage and fibre from the 5½ million acres of irrigated land served by Reclamation projects add to provisions for the West's expanding population. The 13 million tons of products from these lands will be increased proportionately as irrigation is extended.

Like all progress today, Reclamation must adjust itself to make the greatest possible contribution to the national defense.

I am fully confident Reclamation's engineers and others of its staff will respond as always with the highest degree of cooperation.

Sincerely,

Oscar L. Chapman

Secretary of the Interior.

Tapping Lost River

SUBTERRANEAN SOURCES ***furnish refreshment to Fred McClellon on his North Side Pumping Division form on the Minidoka project. The shaded oreo in the map obove represents the bosalt or lovo bed where fugitive underground streoms moy provide o new-found water supply for Idaho formers. Photo by Phil Merritt, Region 1 photographer. Mop by Graphics Section, Washington, D. C., bosed on informotion submitted by the outhor.***

by HU BLONK, Regional Information Officer, Boise, Idaho

A GOOD PLACE TO START A STORY is at the beginning. This one begins about 1 million years ago.

It's the story of how the subterranean Lost Rivers of central Idaho are being tapped by the Bureau of Reclamation for irrigating 64,000 acres of land on the North Side Pumping Division of the Minidoka project—the first time on a large scale that the Bureau has gone underground for its source of water supply.

Briefly, the synopsis of the story is this. Four principal streams, generally referred to as the Lost Rivers, disappear into the lava beds between Arco and Mud Lake, Idaho. Some 125 miles southwest of where this phenomenon occurs, the water from the rivers, together with other underground water, reappears at the surface, in large springs. Between the places where the streams vanish underground and where they reappear, the Bureau is sinking irrigation wells, with results that indicate possibilities of some day making available to World War II veterans some 800 new homestead farm units on public land that now supports only sagebrush.

To elaborate, during the Ice Age, which began perhaps a million years ago, and ended about thirty thousand years ago, more or less, glaciers covered the slopes of the mountain ranges north of Arco. Melt-water poured out of these glaciers to form streams flowing southward onto the plain. They emptied into a prehistoric river, the ancestor of the Snake.

In the course of events, tremendous volumes of lava poured from volcanic vents in the central plain. Molten masses of lava flowed across the Snake River region, pushing the main river 50 or more miles southward from the place where it is today. The lava flow created a huge basaltic barrier in front of the rivers which had been flowing from the northern mountains into the Snake. Some of the individual basalt flows were as much as 100 feet thick. As one flow after another occurred, the mass in places grew to a thickness of 1,600 to 1,700 feet or more.

The trapped or frustrated streams which were blocked by the lava formation had considerable volume. They spread gravel for a few miles from the mountains southward over the lava. However, they could not cross the barrier on the surface. This is graphically illustrated by the Big Lost River, the largest of the disappearing streams. It was deflected from its course and now makes a 180° arc from south to north. The block-ng action of the lava beds is also evident from the fact that for the entire 300 to 350 miles between Henry's Fork of the Snake to the east and the Boise River to the west, there is only one perennial northside surface stream that crosses the plain and reaches the Snake from the North.

However, the basalt was permeable, having large cracks, caverns, some crevices up to several feet in width, and other openings created by the cooling of the mass. As a result, the streams began to sink out of sight through the highly permeable gravel and through the network of fissures in the rock. That's where they are disappearing today.

Underground, the water from the rivers courses through the basalt and finally reappears, together with underground water from other areas, in the beautiful springs, which flow like waterfalls out of the north basalt wall of the Snake River Canyon in the 75-mile stretch between Milner Dam and Bliss, Idaho. Among these are the Thousand Springs. Long a tourist attraction, these springs are among the largest in the United States, if not in the world. The total discharge is estimated to average 5,000 cubic feet per second, or more than 3,600,000 acre-feet annually—about the same as the volume of the Missouri River at Helena, Mont., and more than the Rio Grande near Laredo, Tex.

PROBING FOR PRODUCTION—Below, Blaine Hodges examines a Bureau pump which went underground to find water for irrigating the productive field in the background. At right, Dean Rector displays a first-year sugar beet, watered with the underground supply delivered through a private well. ***Both photos by Stan Rasmussen, Region 1 photographer.***

The underground passage of water through the lava beds of central Idaho constitutes one of the great natural phenomena of the country.

The Bureau of Reclamation has been busy for the past 3 years probing this underground basin beneath the Snake River Plain. It has sunk 10 irrigation wells and 4 observation wells, reaching water at depths varying from 150 to 300 feet. A plentiful supply of water has been found. No matter how long the pumps operate there has been no appreciable drop in the water table. A careful check of the water table is being maintained by the United States Geological Survey through the observation wells and other wells nearby.

Some of the wells are among the largest in the country, delivering 7½ cubic feet per second. Ultimately, if the year-by-year trend indicates the feasibility of full development, 200 wells will pump water to the new area.

Irrigation on the project is already underway, about 1,233 acres being served from 3 of the 10 Bureau wells. Pumps will be installed soon on the remaining 7 to serve approximately 3,893 acres of additional land. Simultaneously with the Bureau development on public land, 20 wells, serving more than 12,000 acres, have been drilled and put in operation on privately owned land.

Despite glowing prospects, the Bureau is cautious about the underground supply. It does not

(Please turn to page 80)

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WRAPPING UP Mirage Flats contract. Regional Director Avery A. Batson; Andrew F. Young, President Mirage Flats Irrigation Board; George Hurst, Board member, and Albert Richardson, Board Secretary. Above, good stand of brome grass on the banks of Mirage Flats project lateral.

Mirage Flats Takes Over

ON EVERY KITCHEN CUPBOARD DOOR of the Mirage Flats in Nebraska is proudly displayed a copy of a contract between the farmers and their Government. At least, this was what the people planned when they asked for extra copies of the document for each farm home.

This contract was signed on December 28, 1950, at the Mirage Flats Community House where settlers gathered to witness the ceremony during which their chosen officials, members of the Mirage Flats Irrigation District Board, affixed their signatures to a document which they had helped to draft, and which stated their willingness to take over the operation and maintenance of the facilities of the project and would begin repaying the United States Government for the construction costs.

Avery A. Batson, director of Region 7 for the Bureau of Reclamation, was delegated to sign in behalf of Oscar L. Chapman, Secretary of the Interior. Signing for the District were: Andrew F. Young, president, and Al Richardson, secretary-Treasurer. The third member of the board is George Hurst.

Many people took notice of the "running start" taken by the Mirage Flats settlers. United States Senators Kenneth S. Wherry and Hugh Butler, and United States Representative A. L. Miller sent telegrams of congratulations which were read to the group by the District's president. Mr. Batson read the following communication from Washington, D. C.:

I have read the proposed contract between the people of the Mirage Flats Community and their Government for the supplying of irrigation water to them. It demonstrates to me the splendid manner in which the people of the community, especially the Irrigation District Board and your representatives, have agreed on this mutual effort. You will recall that negotiations for a repayment contract started in 1948. Prior to that time and up to the present time, water has been delivered to individual water users under water rental arrangements. The operation and maintenance of the project was carried on by Government employees.

With the signing of the contract, the people of the Mirage Flats will take over the operation and maintenance of the facilities and will commence repayment of construction costs to the United States. That is indeed good news to me and I know it will be good news to the Congress. It is further exemplification of the great faith which the people of America have placed in the West and in the water users. Willingness to repay the Treasury of the United States a fair share of the cost of water resource development assigned to irrigation is a basic precept upon which Reclamation was founded.

Mirage Flats project is an excellent example of what cooperation between the people and the Federal agencies can accomplish. Through the Department of Agriculture the Government acquired title to all but eight tracts of land within the project area. These tracts were allotted to individual farmers with priority given to World War II servicemen. It is a modern realization of the dreams of your western Nebraska pioneers.

The start of irrigation upon Mirage Flats is indeed one of the great sagas of the history of Nebraska. Its imprint should reach deep into the minds and hearts of every citizen of the State. I congratulate the people of Nebraska and the people of Mirage Flats Irrigation District upon this achievement. My only regret is that I cannot at this time come to western Nebraska and personally sign the contract on behalf of the Government of the United States.

Accordingly, I hereby delegate that authority to you [Mr. Batson] and urge that you express to the people my sincerest congratulations.

Sincerely yours, OSCAR L. CHAPMAN,
Secretary of the Interior.

Ernie House of Ainsworth, Nebr., president of the Nebraska Reclamation Association and also president of the Niobrara River Development Association, spoke to the settlers, as did Mr. Vern Lindholm, also of Ainsworth, secretary-treasurer of the Niobrara River Development Association. Clyde Burdick, the Bureau's area planning engineer, of Ainsworth, was an interested spectator. He had helped build the project.

"The Mirage Flats project is one of the many important projects included in the long-range program for the development of the land and water resources of the Missouri River Basin," Batson told the more than 300 persons gathered at the Community House.

"Box Butte Dam, Dunlap Diversion Dam on the Niobrara River, major features of the project, plus the miles of canals, laterals and siphons constructed by the Bureau of Reclamation in northwestern Nebraska, will play a major role in alleviating the economic uncertainty of the region.

"Provision has been made for the storage and control of water used to irrigate approximately 12,000 acres of semiarid land. Irrigated farms on the project are already producing quantities of alfalfa in excess of their needs—more even than will be needed under anticipated increased development of livestock feeding programs.

"Mirage Flats played an important part in supplying feed to cattlemen in northwestern Nebraska during the 1948–49 blizzard.

"Its surplus feedstuff, available to cattlemen, adds to the stability of the State's beef-producing industry. Since the initiation of irrigation on Mirage Flats, potatoes, barley, beans, and corn have become money crops and high individual yields have been produced by the project's new farmers.

"No longer are the descendents of the hardy pioneer settlers in the Mirage Flats area dependent upon the vagaries of season and weather for what was, at the best, a precarious living.

"A foundation for a sound, secure agricultural economy was laid when the Mirage Flats project was completed and placed in operation. Signing of the repayment contract places its actual operation in the hands of the people of the area and assures the repayment to the Government of their fair share of construction costs.

"Today the Mirage Flats project is in operation. Settlers who took up the available farms are constructing new houses and other necessary buildings. Mirage Flats is no longer just a 'mirage.' It is a reality!"

(See the January and February 1950 issues of the RECLAMATION ERA for Parts 1 and 2 of "Mirage Flats Project"—Editor's note.)

After the formal signing portion of the ceremony the group engaged in a question and answer period, and decided to employ Earl Winchell, a Bureau of Reclamation employee at Guide Rock, Nebr., as the District's project superintendent.

On January 1, 1951, the Board took over the project, starting a new year, right, by getting off to a good start in operating what a former commissioner of Reclamation, Harry W. Bashore, in 1948 called, "the best looking 3-year-old project" that he had ever seen in his life. It is even better looking now. THE END.

O. S. Warden, Reclamation Leader, Dies

O. S. Warden, a key figure in Western Reclamation development for a half a century, died at his home in Great Falls, Mont., on March 12. He was also publisher of the Great Falls Tribune and a director of the Associated Press.

As one of the first presidents of the National Reclamation Association, serving from 1935 through 1944, he contributed greatly to the overall expansion of the Reclamation program. Among specific projects for which he is particularly responsible is the Canyon Ferry Dam, a unit of the great Missouri River Basin.

His statement "The court of public opinion is making up a verdict. The Nation, I think, is aware. If we have a new prosperity, industry and agriculture—both will take their places as cornerstones. Reclamation will then be secure," made during his second year as president of the National Reclamation Association, in the dark days of the depression, best expresses his faith in Reclamation and its future. •

Reclamation's Hall of Fame

Nomination No. 11

W. G. SLOAN

CO-AUTHOR OF THE MISSOURI RIVER BASIN PLAN

"IMAGINATIVE PLANNING * * * farsighted vision * * * distinguished service * * * leader in the field of conservation and fact-finding * * *" are terms used by Secretary of the Interior Oscar L. Chapman in describing W. G. Sloan, nationally renowned Bureau of Reclamation engineer and author of the original "Sloan Plan" for the multipurpose development of the Missouri River Basin, who retired from Government service on December 31, 1950.

Before his retirement, as chairman of the Interior Missouri Basin Feld Committee, Mr. Sloan had seen his multipurpose plan for the development of the water resources of the Missouri River drainage basin materialize, with 15 major dams completed or under construction and thousands of acres of dry land ready for irrigation.

As chairman of the field committee, with headquarters at Billings, Mont., Mr. Sloan was in charge of the coordination of the work of the seven Interior Department agencies participating in the comprehensive development program. Until his retirement, he was the representative of the Interior Department on the Missouri Basin Interagency Committee—a group composed of the representatives of the 5 Federal departments interested in the basin development and 5 governors representing the 10 Missouri Basin States affected by the development plan. He had headed the field committee from the time of its inception in January 1947. He had been a member of the interagency group since September 1946 and served as chairman of the group from April 1949 through June 1950.

Prior to his departure for San Diego, Calif., Mr. Sloan was feted at a round of dinners and luncheons.

At North Platte, Nebr., on December 1, Sloan was honored at a luncheon attended by governors or their representatives from the Missouri Basin area and representatives of the Federal departments participating in the basin-wide program. The highlight of this luncheon was the presentation, by Assistant Secretary of the Interior William E. Warne, of the Interior Department's highest honor—the Gold Medal Award for Distinguished Service. At this meeting one of the Omaha World-Herald staff members described W. G. Sloan as "a man whose imprint on Missouri Basin history is etched deeply."

In a brief talk, Sloan indicated his heart would be in the Missouri Basin and the development program which his foresight and engineering ability helped start. Mr. Sloan's voice broke with emotion as he described his work on the Missouri Basin program as "10 of the happiest years of my life," according to the World-Herald reporter.

At Denver, Colo., on December 14, Mr. Sloan was feted at a dinner held by the members of the Interior Missouri Basin Field Committee at which the Bureau of Reclamation's Chief Engineer L. N. McClellan was one of the principal speakers and A. D. Molohon, Regional Director, Bureau of Land Management, Billings, Mont., was toastmaster.

Friends and coworkers of Mr. Sloan in the Bureau of Reclamation, including K. F. Vernon of Billings, Mont., director of the Bureau of Reclamation's Region 6, and former Regional Director H. D. Comstock honored the retiring engineer at a dinner December 27 at Billings. Participating in the dinner event were representatives of the Bureau of Land Management, Bureau of Indian Affairs, Fish and Wildlife Service, National Park Service, and United States Geological Survey.

On January 5, the Reclamation associations of Montana, Wyoming, and North and South Dakota sponsored a testimonial dinner at the Billings Commercial Club to honor Mr. Sloan. More than 100 friends from the Missouri Basin area were on hand to laud the retiring engineer and almost 200 more sent letters of tribute. W. W. Gail of Billings was toastmaster, and H. L. Buck, secretary of the Montana Reclamation Association, was in charge of arrangements for the event.

Mr. Harry E. Polk of Williston, N. Dak., president of the National Reclamation Association, recalled in his address that Mr. Sloan first unfolded his plan for the Missouri River Basin at the first annual meeting of the North Dakota Reclamation Association at Minot 10 years ago. The speaker pointed out that "Mr. Sloan's plan for the basin-wide resource development was the first and was followed by similar plans for the Colorado River, the Columbia and other major river basins."

Brig. Gen. S. D. Sturgis explained that "Glenn Sloan's plan for the economic development of the Missouri River Basin is not only a matter of great importance in time of peace, it is of vital importance to the Nation in the critical years ahead." He commended Mr. Sloan for having the courage to conceive his plans for the Missouri River Basin and the courage to present these plans. He explained that "it is not only an engineering plan, but a plan of great social significance."

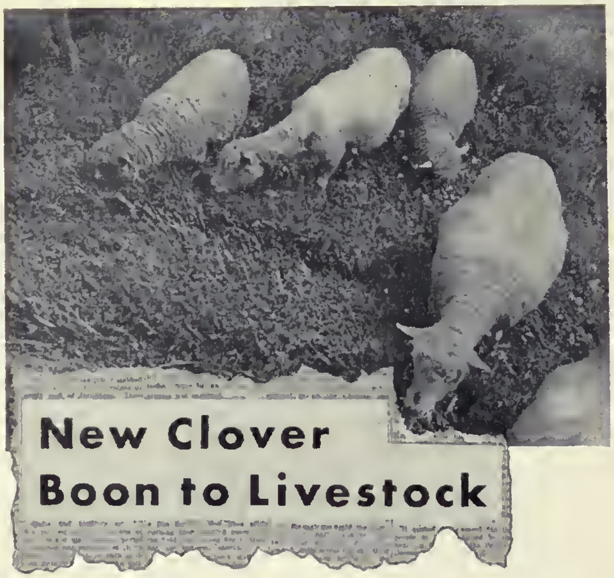
In presenting a lifetime membership in the North Dakota Reclamation Association to Mr. Sloan, R. L. Dushinske, president of the North Dakota Reclamation Association, explained that his tribute came not only from the 15 North Dakotans who were in attendance, but "represents as well the gratitude of the entire State of North Dakota."

H. L. Halvorson of Minot, N. Dak., pioneer North Dakota reclamationist and official of the Missouri-Souris Projects Association, said, "Glenn Sloan taught us the possibilities of resource development and what can be accomplished in North Dakota through the use of the State's water resources. I want to thank you [Mr. Sloan] for all you have done for our great State."

Speaking of the structures erected, under construction and planned in the Missouri River Basin, as a part of the Missouri River Basin project, Raymond F. Lund, former president of the South Dakota Reclamation Association, referred to them

(Please turn to page 79)

MISSOURI BASIN PLANNERS W. G. Sloan and Maj. Gen. Lewis A. Pick, right, authors of the famous Pick-Sloan plan for putting the Missouri to work. Sloan, Senator Butler of Nebraska, and Commissioner of Reclamation Straus at Trenton Dam dedication. Assistant Secretary of Interior William E. Warne reads citation as Gov. Val Peterson of Nebraska pins Gold Medal on Sloan. ***Photos by Nortan T. Novitt, Region 7 photographer.***



New Clover Boon to Livestock

A CLOVER THAT GROWS IN THE WINTER and is ready for heavy pasturing early in the spring, earlier than common forages, sounds interesting, does it not? Subterranean clover, or subclover for short, meets those requirements and the announcement of an improved strain of this legume at the Oregon experiment station has emphasized its possibilities.

Nangeela is the name of the new subclover. It was brought in from Australia and planted at the Oregon station, where it was observed for 10 years before its recent release to the public. Previous to this time, Mount Barker, a midseason type, and Tallarook, medium late, have been the preferred strains but Nangeela, which is winter-hardy, fast-growing and an excellent producer of both forage and seed, excels both of them. It is ready for spring grazing earlier than Mount Barker and it grows as late in the summer as Tallarook but it matures seed about as early as Mount Barker. Moreover the new kind has distinct leaf markings that make identification easier and more exact than with the other varieties. Seed increase plantings have been made for 2 years, both in 1949 and in 1950.

The first planting of subclover in Oregon, and one of the first in the United States was made (with seed which also came from Australia) in 1922. The forage commanded very little attention, however, until 1937, when dairymen in western Oregon began to recognize its value. Since then they have taken to it in large numbers and, at the moment, they have 100,000 acres of pasture consisting of subclover mixed with grass-rye grass, orchard grass, one or more of the fescues, or Highland bentgrass. Oregon extension service people say that in the future the acreage will multiply more rapidly and that in another 10 years the Willamette Valley will have 1,000,000 acres of subclover, an amount equal to half of its total pasture acreage. Eighty-five percent of the farmers in Marion County, Oregon, already have 10 to 15 acres each in subclover and alta fescue. They never had good pasture early in the year before. When the clover stops growing, they have supplemental grass to use until the clover gets started again.

This nutritious legume is an annual but, when given a chance, it reseeds itself year after year. Subclover is established by planting 8 pounds per acre of inoculated seed alone, or 3 pounds with 15 pounds of grass seed, in September. In Oregon the crop is treated with gypsum and treble superphosphate in the spring. Growth is rather slow at first, during the fall and winter, but toward spring it picks up and begins to produce a mass of growth, which is available continuously for heavy grazing until late June or early July, when the plants mature their seed and die. In the fall the seed germinates and another year's crop thus is started.

Subclover buries its seed heads beneath the vegetative mat that the plant forms, which is the reason it is described as subterranean. When the seed is harvested a 5-foot lespedeza cutter bar is used, tilted forward, to pick up the heavy clover plants. The mower knife is operated at a high speed. Standard stationary separators are used to thresh the seed.

Crops people who have seen subclover expect, on the basis of its performance, that in time it will be distributed widely from Oregon to other States. It is adapted wherever winters are moist and mild. They believe it will become important as a pasture crop all along the west coast and in the South. Subclover seed for trial has been sent from Oregon to a number of southern experiment stations.

(Reprinted from the October 1950 issue of "The Northwest," official monthly publication of the Northern Pacific Railroad.)

BELLE FOURCHE VS. CRAYFISH

Today's Battle Against Canal Saboteurs in South Dakota

by W. N. PARMETER, Settlement Specialist, Missouri-Oahe District, Huron, S. Dak., and FRED C. WINKLER, Project Manager, Belle Fourche project, Newell, S. Dak., both of Region 6 (headquarters at Billings, Mont.)

There is nothing backward about the vicious chiseling of "crawfishing" crayfish when it comes to damaging irrigation canals. These silent saboteurs dig by day and by night, and unless checked in their destructive work, are sure to bring about a leak in the dike! A battle is going on today at the Belle Fourche irrigation project, Newell, S. Dak., where crayfish have become a serious problem in the efficient operation of the canals and laterals. The Belle Fourche people are using some unique methods of eradicating and controlling these burrowing creatures.

The main damage occurs when these crustaceous "saboteurs" dig holes through ditch and canal banks and around irrigation structures, so that the bank or structure washes out if not repaired in time. In one case on the project, a hole 35 feet long, from the canal to a drainageway, caused a shutdown of irrigation activities until the canal could be repaired.

People say that the crayfish was introduced to the Belle Fourche irrigation project many years ago by an enthusiastic angler who wanted bait to catch big lake bass. He got some crayfish and planted them in an irrigation canal near his farm. The crayfish thrived, and multiplied. Today their anti-Reclamation activities cost the irrigation district about $5,000 in yearly damages to the project canals and structures.

The adult crayfish, 3 to 6 inches long, resembles a miniature lobster. He is of a dull greenish or brownish color, often diversified with a little pale yellow below and sometimes with a little red about the legs. He burrows into banks of streams and irrigation canals and lurks at his den opening with great claws ready for any unsuspecting passer-by. He eats bugs, roots, small fish or almost anything he can lay his claws on. He has four highly developed senses—sight, feel, smell, and taste. The fifth sense is missing; the crayfish is stone deaf. He feels his way in the dark with two sets of antennae. At the base of the short antenna are the balancing ears. If both ears are injured the crayfish will float upside down. Also near the base of the short antenna are the taste and smell bristles. The crayfish walks with its head foremost and swims with the tail foremost. If a crayfish's limb gets caught, bruised or broken, he (or she) sheds it and grows another one in its place.

In the autumn the mother crayfish makes a temporary nest by bending her tail forward, and "liberates" the eggs, like small unripe currants, into the nest. At the same time she glues the eggs into the basket with a secretion from the underside of her tail. When the eggs are firmly fastened to small paddlelike limbs called swimmerets, the male crayfish fertilizes them. The young are hatched in the spring. A crayfish in the progress of its growth goes through eight moults the first year, five the second year, and two the third year.

Aromatic solvents are very effective in eradicating this pest. However, it is difficult and expensive to get rid of the crayfish completely, as all canals and ditches should be treated at the same time. This crafty little creature infiltrates into ditch banks and canal layouts. During the aromatic solvent treatment the flow of water must be reduced to about 1 cubic foot per second with a velocity of approximately 1 foot per second, and the attack should be made in the warm summer months before the crayfish burrows into the ground for the winter. When the water was low enough, we loaded a high-pressure sprayer with an aromatic solvent, placed a small orifice nozzle under water for 40 minutes, until the water was milky 200 feet downstream, and got good results. The concentration of the solvent in water should be about 550 parts per million.

Light charges of dynamite have also been used successfully in stopping leaks under banks, and small washouts around structures have been backfilled with gravel.

An effective control method of saving a structure or ditchbank where a washout has started is to fill the crayfish hole with a slippery or soupy cement mixture called grout. A satisfactory and inexpensive grout mixture is composed of one-fifth part cement and four-fifths topsoil with enough water added so the grout can be applied in a liquid form. The cement, topsoil, and water are placed in a mixing tank on top of a mud jack pump which has a 1¼ horsepower air-cooled gasoline motor. The motor does double duty—it furnishes the power to mix the grout and pumps it through a special nonclogging ball valve and a hose with a nozzle applicator. The grout is applied under a 20- to 40-pound pressure. The hose must be pushed into the crayfish holes so that the grout will fill every crevice, and seal each crayfish burrow down to the last nook and hideout. Solvent naptha is used in the grout mixture to kill any crayfish that may be trapped in the hole. From 1 to 70 cubic feet of grout have been used in repairing structures by this method.

In one instance, we had to repair two large drops that were threatened by numerous burrows and general undermining. This job required 110 cubic feet of grout made from 100 sacks of cement

at a cost of $173 for material, labor, and equipment. We did not have a mud jack pump at the time and had to use a duplex piston-type pump which was designed to handle only straight cement grout. Repairing these two drops by the old manual method, using hand shovels to dig out the honeycombed area, and refilling and packing down the excavation, would have cost $450. The same results could have been obtained for $94.70 by using part topsoil in place of cement in a ball valve mud jack pump which is now part of the equipment on the Belle Fourche project.

Again, necessity is the mother of invention. The Belle Fourche irrigation district has fully recognized the crayfish problem and is gradually winning its battle against this uninvited guest.

THE END

PUBLIC ENEMIES driven into the open by solvent naphtha on Belle Fourche Irrigation District, at left. Ditchrider Victor Norlin using solvent naphtha (Dead-X) on crayfish in Townsite lateral. *Photo by F. C. Winkler, Region 6.*

CLOSE UP OF A CULPRIT—Adult crayfish below. *Photo by F. C. Winkler, Region 6.*

HE TOOK TIME TO SAVE TIME—John T. Moletic (left) worked ofter hours, nights ond week ends to prepore time-soving formulos for weed control. Here, Regionol Director Avery A. Botson congrotulotes him upon receiving the Deportment of Interior Honoroble Mention Aword for the achievement.

SHORT CUTS TO WEED KILLING CALCULATIONS

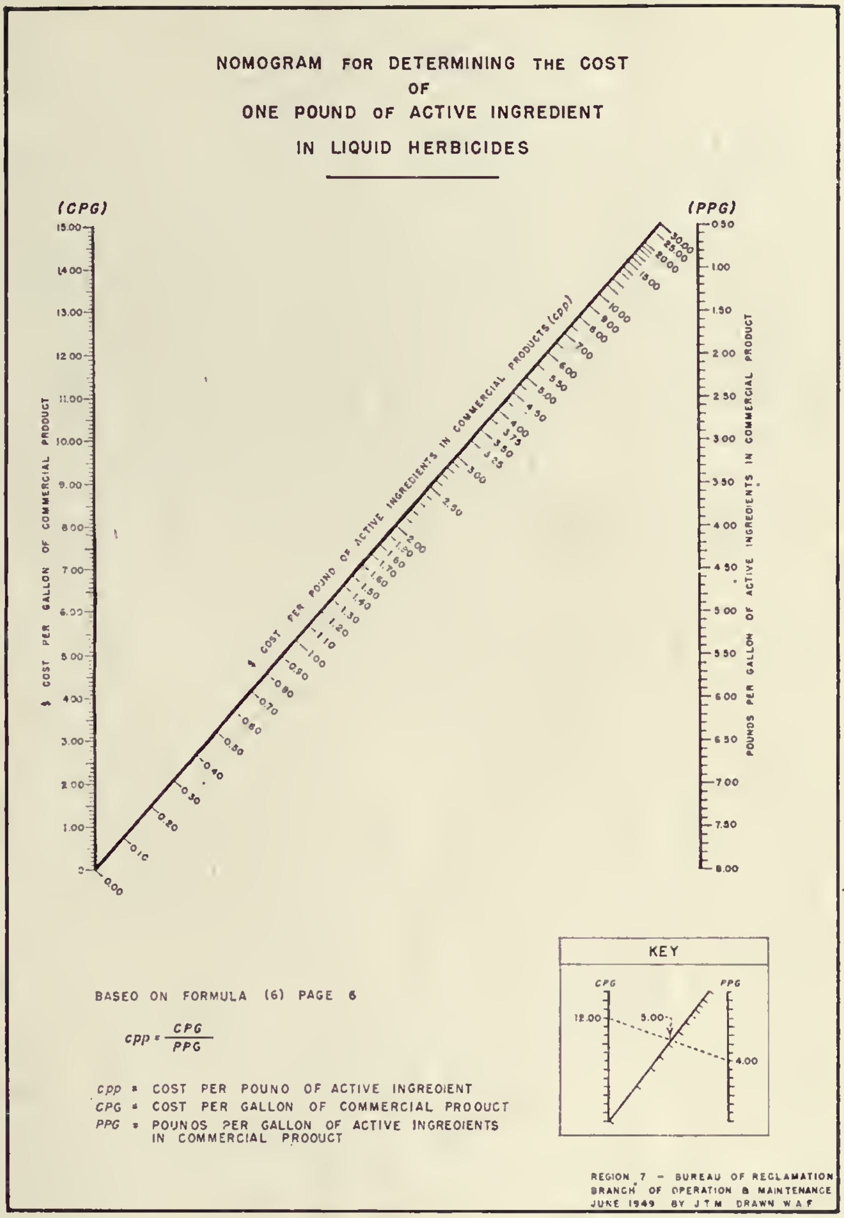
Suppose you want to get rid of some weeds, and someone advises you to spray them with 2,4-D. When you go to the store, there are half a dozen or more different varieties of 2,4-D staring you in the face, all with different price tags attached. Which one should you buy to get the most for your money?

This is one of the many questions which crop up during weed control time, and the answer to this one, plus many others, can be found in the handbook entitled, "Weed Control Calculations," by John T. Maletic (pronounced mah-*lett*-ic) of Denver, Colo., soil scientist and weed specialist of the Bureau of Reclamation's Region 7. Mr. Maletic, who wrote this book mostly on his own time, since his other duties kept him busy during his regular working hours, received a medal for meritorious service from Secretary of the Interior Oscar L. Chapman because of his outstanding achievements beyond his regularly required duties.

During the last few years a wide variety of chemicals and equipment have been devised to control weeds. Mr. Maletic wrote his handbook so Bureau of Reclamation officials and water users on irrigation projects could make the most of these compounds by preparing and applying the correct mixture, in the most effective manner, and at the lowest practicable cost. The 127-page handbook, "Weed Control Calculations" is primarily concerned with *how* to prepare and apply the new chemicals, both liquid and powdered types. Mr. Maletic's book does not contain information on *when* and *where* to apply the herbicides to get the best results. These items are also important in weed control work as the farmer can lose a great deal of time, effort, and money if he treats weeds at the wrong time, or uses a chemical to kill certain kinds of weeds only to discover that it has little effect in that particular area. The "when" and "where" to use different herbicides is often a local problem and advice on these points usually can be obtained from county agents, State and county weed experts and from weed control bulletins. However, the handbook has been helpful to the conscientious farmers and agents who were looking for information on how to choose the most economical chemical for the job, how to mix the chemicals, and how to figure the speed of the rig, the spacing and discharge rate of nozzles, how to apply the desired volume, and how to adjust the spray nozzles so the entire leaf surface of the weeds is drenched.

Proof of its popularity has been the demand for the handbook by members of private irrigation districts, county agents, State and county weed officials, chemical manufacturers and others who need

ГTING THE MOST FOR YOUR MONEY made easy by using this nomogram. e word nomogram is the preferred odern spelling for the word nomo-aph which simply means a chart which u can use to find answers to problems thout resorting to mathematical for-ulas. A straight edge, plus informa-n on two items, will help you find e answer to the third item on this one, hich is designed to help you find out w much each pound of active weed-ling ingredient costs when you buy in liquid form. By law, the amount the active ingredient must be stated the label. If, as shown in the ex-nple in the key appearing in the low-right-hand corner of this monogram, e price per gallon is $12 (CPG scale) d the product contained four pounds the active ingredient (see PPG scale), e price of the part that does the work ll be found where a straight line awn between these figures cross the agonal line (CPP scale) which gives u the answer—$3 per pound. Now it with your own ruler. Say a oduct costs $4.90 a gallon and con-ins 3.5 pounds active ingredient per llon. Place your straight edge on 90 on the left-hand scale and 3.5 on e right-hand scale and you will find crosses the diagonal scale at 1.40 hich means that each pound of active gredient costs $1.40 per pound. If other product costs only $4 per gallon t contains only 2.5 pounds of active gredient you will find the chemical at does the work is costing you $1.60 r pound.



his information. Now several colleges use the ook in weed control courses and it is being trans-ted by several foreign countries. Lowell Watts, rm editor for radio station KLZ, Denver, Colo., nsidered the publication important enough to terview Mr. Maletic who, during the broadcast, xplained the uses of the book and pointed out how roper use of weed-killing chemicals has helped armers increase their farm income and how the Bureau has reduced operation and maintenance osts through more efficient weed control methods.

Let us get back to our problem regarding price ags on 2,4–D. Before Mr. Maletic prepared his handbook, you would have had to work out compli-cated mathematical formulas to arrive at the answer. With the aid of the nomogram on this page, reproduced from the handbook, you can find out in a few moments which of the commercial products of a given type will do your job at the lowest price. There are 13 of these nomograms in "Weed Control Calculations," preceded by in-formation on how each formula was worked out and giving examples of applying the formulas to practical problems. Future issues of the ERA will contain further information on how to use these nomograms. THE END.

OUR SOUTH AMERICAN NEIGHBOR has a way of irrigating tobacc by the spray method at Hacienda San Pablo, Tumero, Estad Avagua, Venezuela. Inset, Dr. Luis J. Medina, to whom we ar indebted for this photo.

TWO-WAY STREET

Venezuela, the "Little Venice" of South America, was written up in the pages of the December 1949 issue of the Reclamation Era by John L. Mutz, area engineer of Albuquerque, N. Mex., of the Bureau's Region 5. Mr. Mutz is one of several engineers and irrigation experts from North America who have given technical assistance to our neighbors south of the equator. Here is evidence that Inter-American cooperation is a two-way street, and much can be learned from Latin America—a translation from a bulletin written by Dr. Luis J. Medina of Venezuela's department of agriculture:

INTRODUCTION

Irrigation, considered as a supplement to the natural precipitation for the production of food or fibers, regardless of the place where it has been established, is fundamentally an activity of an agricultural type.

The construction of a dam, a reservoir, or a canal for irrigation has as its main objective the establishment of economically sufficient farms where they did not exist before, or to transform, by means of water which Nature does not provide, farms or cattle ranches into self-sufficient production units. Without weighing down the scale on either side it can be stated that the construction of a dam, for example, is an essential, but not the most important factor for the success of the enterprise. The main objective is the improvement of the land and the best use of water for the welfare of those who during many generations wi use those resources for agricultural purposes.

The farms established or benefited by means of the con struction and development of irrigation projects shoul not be considered simply as a guarantee for the payment the cost of the engineering works, but on the contrary, the basis for the development of stable agricultural ente prises and prosperous and progressive rural communitie

In all lands under irrigation the principal purpose none other than that of obtaining the greatest efficiency i the use of water, which is transformed into high productio during the maximum possible number of years withou causing any damage or deterioration to the lands. Th requires the adoption of rational methods for the prepar tion of the soil, the application and use of water, etc.

In the present publication, an effort has been made t include a group of general rules on irrigation, the know edge of which is considered useful to persons engaged i this activity, in the hope that it will contribute in son way to the improvement of present practices.

The Bureau of Reclamation's chief of irriga tion operations, M. R. Lewis, who has spent con siderable time in South America, obtained D Medina's permission to use this translation an to translate and reprint any other excerpts fro the bulletin which would be of interest to ou readers. The title of the bulletin is, "Norma Generales sobre Riego con Especial Referencia Maiz, Arroz y Hortalizas", which, in genera means, "General Procedures About Irrigatio With Special References to Corn, Rice, and Tru or Garden Vegetables." The Ed

W. G. SLOAN

Continued from page 71)

s "living monuments to the services Glenn Sloan as rendered South Dakota and the Missouri River asin."

In explaining his plans for the future, Mr. Sloan id "I am going to sit in the sun and get a new ewpoint, start a new life * * * I am not oing to forget the Missouri Basin. The plan is oving along. It will continue to move." He plained that "unity, nonpartisan unity of purose, the will to work together for a common cause, as been one of the dominating trends in the proram in which we are all interested * * *. here has been no contention in the Missouri iver Basin—here we have 10 States working gether. * * * We have proven that the Buau of Reclamation and the Corps of Engineers an work together with all agencies, Federal and tate, and with the people for a common purpose."

Prior to becoming head of the Interior Missouri asin Field Committee, Mr. Sloan was the assistnt director of Region 6, Bureau of Reclamation, position he had held since November 1943. When rst joining the Bureau in 1936, he was selected to ead investigations of the Rio Grande and the Iissouri River Basin. It was during this period hat he conceived and formulated the plan for the evelopment of the resources of the entire Missouri iver Basin as one gigantic project, with the inividual development considered component and tegral parts of the over-all plan.

For 4 years previous to his association with the ureau of Reclamation, Mr. Sloan was a special igineer for the Twin Falls Canal Co. of Twin alls, Idaho, being engaged on the design and onstruction of a spillway for Milner Dam and ther reclamation engineering problems.

From the time of his release from the Army as first lieutenant until 1932, Mr. Sloan maintained private engineering practice at Boise, Idaho. or 6 years before entering the Army Corps of ngineers, Mr. Sloan was in charge of drainage nd investigations for the Department of Agriculure in Idaho and adjoining portions of Oregon, Vyoming, Montana, and Utah.

Born in Paris, Ill., on August 2, 1888, Mr. Sloan s a graduate of Helena, Mont., high school and Iontana State College. He is married and has ne son, a California newspaperman. The End.

BEAMING OVER BENEFITS seems to be the theme of this photo of the directors of the Orland Unit Water Users' Association as they reviewed the final work in a $250,000 rehabilitation program. (See "Orland's New Look" in December 1950 issue of the Era.) The association represents the water users in their relations with the Government. Seated, from left to right, George Naugle, Leonard W. Gollnick (president) and Mrs. Berrie Kiley (secretary). Standing, from left to right, Stephen R. Angus, Jesse Monroe (vice president), Frank Lourenco, Jasper Litchsteiner and Frank I. Nichols.

Fourth Sale of Full-Time Columbia Basin Farms

April 13, 1951, is the deadline for submitting applications for the purchase of 20 Government-owned farm units on the Columbia Basin project, 120 miles southwest of Spokane in eastern Washington. Veterans of World War II will have preference in buying these units, which are in the Quincy Irrigation District, which, along with more than 600 privately owned full-time farm units, will receive water in 1952 under the project plan for full-scale irrigation operations.

The units, which are obtainable only by purchase, and not subject to acquisition through entry and settlement under Federal homesteading procedure, range in size from 30 to 143 irrigable acres. All of the farm units are unimproved except one; the prices of the unimproved units range from $410 to $1,867, while the improved unit, containing 100 irrigable acres, is appraised at $6,485.

Copies of the announcement and application blanks may be obtained from the Bureau of Reclamation at Ephrata, Wash., or from the Bureau of Reclamation, Box 937, Boise, Idaho. A public drawing will be held to establish the order in which applications will be examined and in which applicants who are found qualified may purchase the full-time farm units. •

Tapping Lost River

(Continued from page 67)

propose to open up the entire area to homesteading at once. Instead it will sink 10 more wells during the next fiscal year and about 20 every year thereafter until the required total number is reached. Block by block, the new land will be made available to World War II veterans, the first public drawing to be held in 3 or 4 years. It is anticipated that about 15 years may be required fully to develop the North Side Pumping Division.

During the testing period to determine the adequacy of the water supply, land around the wells is being leased, on a competitive basis, to farmers at an average of $10 per acre per year for 4 years. Excellent yields of beans, clover seed, sugar beets and forage crops have been realized from the newly cultivated areas.

In addition to the 64,000 acres that would be served from the underground water, the Bureau has also been authorized by the Congress to use water from the existing American Falls Reservoir and the proposed reauthorized Palisades Reservoir to serve 13,650 acres on the project throu[g] the usual surface irrigation methods.

The use of the underground supply for irrig[a]tion of what may eventually total 100,000 acr[es] probably will have little effect on either the beau[ty] or the volume of the Thousand Springs. T[he] Geological Survey explains that the Federal pro[j]ect and private developments will use betwe[en] 1,300 and 1,500 cubic feet per second during t[he] peak of the irrigation season, as compared wi[th] the spring flow of 5,000 cubic feet per secon[d]. Normally about 50 percent of an irrigation supp[ly] seeps back into the ground; thus the net draft [on] the underground flow in this instance wou[ld] amount to only 650 second feet. Irrigation pum[p]ing from these wells would occur only during t[he] growing season, about one-third of the year, t[he] annual loss amounting to an average withdraw[al] of only 217 second feet, or about 3 to 4 percent [of] the total spring outflow. Whether the effect [on] Thousand Springs will be felt during the summ[er] season or at some later date is not known, but wi[ll] be determined with the aid of observation wel[ls] and gaging stations now in operation. THE E[ND]

POWER PLANT driven by some of the Thousand Springs. The outflow, totaling about half the flow of the Snake at this point, is shown in the stream in the foreground—once lost and idle, n[ow] found and productive. ***Photo by Phil Merritt, Region 1.***

Riverton Project Lands Transferred to Water Users

Secretary of the Interior Oscar L. Chapman announced the transfer of the irrigation works serving 48,000 acres of land on the Riverton, Wyo., project to the Midvale Irrigation District for operation and maintenance on January 1, 1951.

The transfer provides that the Midvale District shall be responsible for the care, operation and maintenance of Bull Lake and Pilot Butte Reservoirs along with Wind River Diversion Dam, part of the Wyoming canal and pertinent laterals serving the lands included in the first and second divisions of the project.

The Bureau of Reclamation will continue to operate the Pilot Butte power plant and the third division of the project part of which has been placed under irrigation and is being readied for GI homesteaders.

Acting Commissioner of Reclamation, Goodrich W. Lineweaver, speaking of the transfer, said "It is the continuing policy of Reclamation to encourage water users to take over and operate their own irrigation distribution systems as soon as they are in a position to assume this responsibility." To date 48 out of 65 completed projects or divisions of projects are operated by water users.

The Midvale District will acquire the necessary equipment to carry on the operation and maintenance of the project and Karl Bowers, the Bureau's administrative officer on the project, will be loaned to the District to serve as manager.

The project was authorized in 1918, construction started in 1920, and irrigation water was first available in 1925. Ultimate development calls for the irrigation of 95,000 acres. Before World War II approximately 42,000 acres were irrigated. •

Contract Awarded for Folsom Generators

The Bureau of Reclamation recently awarded a contract to Westinghouse Electric Corp. of Pittsburgh, Pa., for the fabrication and installation of three generators in the Folsom power plant on the American River near Folsom, Calif.

This plant is a feature of Folsom dam being built by the Corps of Engineers, and is an integral feature of the multipurpose water resource development of California's Central Valley. The Bureau of Reclamation is responsible for the power development at Folsom Dam which re-

IRRIGATION DISTRICTS in the Pacific Northwest seem to have a good idea here. These new posters, prepared by a photographic process, are to be displayed in irrigation district offices in Washington, Oregon, and Idaho. The girl is Darlene Moran of Boise, Idaho. Other irrigation districts and water users associations are welcome to the idea, and the Bureau of Reclamation hereby congratulates the Pacific Northwest for this support of the reclamation farmer's own publication.

quires three generators each of 54,000 kilowatt capacity. Under normal conditions, these units could generate almost 400,000,000 kilowatt-hours of energy annually for irrigation pumping, municipal, domestic, and industrial use in this power deprived area.

The first unit is scheduled for installation in 2 years and 340 days; the second in 3 years and 165 days; the third in 3 years and 155 days. The first unit is scheduled to go on the line by June 1954 and the other two before the end of that year.

Jacob E. Warnock Honored Posthumously

The Department of the Interior gold medal for distinguished service has been awarded posthumously to Jacob E. Warnock, former head of Reclamation's Hydraulic Laboratory in Denver, Colo., Secretary of the Interior Oscal L. Chapman announced on January 24.

Mr. Warnock died in Denver on December 26, 1949, after an emergency operation. (See Reclamation Era—February 1950, p. 43.)

Secretary Chapman said "many features of multiple-purpose water resource conservation structures in the 17 western States bear the stamp of Mr. Warnock's achievements in the field of hydraulic engineering." •

WATER REPORT

On March 1, snow on the mountains and water in the reservoirs guaranteed plenty of irrigation water for Bureau projects in the Colorado River Basin, most of the Missouri Basin and in the Sacramento - San Joaquin district. Heavy rains and melting snows caused some rivers to run bank-full in the northwest. In the Great Basin, the main stem of the Colorado River and the Pecos Basin, the signs pointed to an adequate supply, although Rio Grande and Salt River Basin projects had no reason to hope for relief from the continuing drought. As a matter of fact, in Arizona, New Mexico, and Texas, a severe water shortage is developing as the flow into reservoirs decreases. Flow into Roosevelt Reservoir of the Salt River project hit a record low for the sixth consecutive month.

By regions (see map on back cover to locate areas) the situation is as follows:

REGION 1.—Early forecast indicates that all projects should have enough water to meet the next season's irrigation needs. In the Malheur drainage area serving the Vale project in eastern Oregon, although the water content of the snow is not as it has been in the past, and the reservoir storage continues below normal, the farmers should have enough water to irrigate next season's crops. The Okanogan project in northern Washington received only half the amount of snow or rain for this time of year. In addition, this project experienced unusually warm February weather which melted the snow rapidly, thus cutting down the possibility of heavy spring floods. On the Yakima project, in southern Washington, however, it was colder than usual and the snow and rain was about 180 percent of normal. It is a little early to predict spring weather conditions, but if the snow continues to accumulate as it has, and if cold weather prevails until the return of spring, the northwest floods may again cause damage in vulnerable areas.

REGION 2.—All the reservoirs which already were full enough for this time of year received more than the usual amount of water during February. The flow of the Sacramento River into Shasta Lake amounted to 179 percent of normal and the San Joaquin River into Millerton Lake amounted to 210 percent or normal for this year.

REGION 3.—Snow cover on the head waters of the Colorado River in Wyoming and Colorado which eventually will melt and flow into Lake Mead was generally above average for March 1 and considerably above last year. However, Lake Mead can hope for little snow melt from the drainage areas in New Mexico as snow has accumulated at a disappointingly slow rate and no snow remains in the lower elevations. Even though the flow into Lake Mead was only 90 percent of normal, the large hold-over storage gave ample assurance that the projects using Lake Mead water will have abundant water to irrigate their crops. By February 15 only a few snowdrifts remained on the Verde River watershed and there was practically no snow remaining on the Salt River drainage area below 8,500 feet.

Beneath the snow, wherever it could be found, was dry soil which will probably absorb most of the snow melt leaving very little water for the reservoirs of the Salt River project which now are critically low.

REGION 4.—In this, the intermountain region, many of the projects carry over very little stored water because their reservoirs are small, their capacity being only large enough for yearly irrigation needs. These projects rely on each year's snowfall for water to irrigate their crops during the coming year. While not seriously low, the snowfall this year has been below normal on the Mancos Fruit Growers Dam, and Pine River project in Colorado. For the rest of the region, there seems to be enough snow cover to supply the reservoirs with ample water for this summer's irrigation needs.

REGION 5.—Except for the Rio Grande project in Texas and New Mexico the reservoirs are storing as much water as usual for this time of year. On the W. C. Austin project in Oklahoma, due to more than 4 months of drought, water was delivered during February to pre-irrigate potato land, and to irrigate alfalfa and winter wheat. In spite of this release of stored water, the Altus reservoir was about one-third of a foot above the uncontrolled spillway. Due to extremely low run-off into Elephant Butte no stored water is being released to the Rio Grande project and soil moisture conditions are reported as poor. Private wells are being dug and pumps are being installed to pump drain water to supplement surface water. Under these circumstances the water users have agreed to ration the project stored water at the rate of 1 acre-foot per acre during the next irrigation season—until and unless storage increases.

REGION 6 and REGION 7.—There seems to be sufficient water in prospect for next year's crops. On the Belle Fourche project in South Dakota the field reports the outlook for the reservoir as poor instead of the previous report of fair. Flow into the reservoir was below normal during the month and very little runoff can be expected from the snow and the drainage area above the reservoir. ●

CROPS

Castor Beans on the W. C. A
Project

Castor beans were raised on the Austin project in Oklahoma, fo first time in 1950. A commercial c bean company contracted with farmers to buy their entire produ and guaranteed to pay 6 cents a p or the New York market price, w ever was greater. For the mon September the price paid farmers 9.4 cents a pound, dropped to 9 ce pound on October 1, and had held s at that price since. There has bee distinction made in the price of b for the oil mill and the price of saved for seed.

There were approximately 950 raised in the irrigation district in and some 500 acres in nonirrigated in this vicinity. Castor beans were raised in Oklahoma, near Fred Sayre, Eldorado, Mangum, and Me ter, and at Quanah and Vernon, T

The crop was planted on all typ soil, ranging from deep sand thr loam to tight clay, but seemed to do under irrigation in loamy soil. fields should have good surface d age. A few fields planted on level ders were drowned out during the weather.

Methods of seed-bed prepara planting and cultivation are very si to those used in raising co Farmers who are producing cotton therefore equipped to raise c beans. The beans do not need as cultivation as cotton, nor is it neces to thin the stand by chopping. S there has been no insect damage.

Very little irrigation was used on crop during 1950 because of the usually wet summer. It is thought about the same amount of wate needed as in the production of co and that in a dry year frequent ir tions will be necessary.

The beans grow inside pods or b The burrs are fastened to the plan clusters called spikes. The plants putting on spikes early, and con forming spikes at the top as the p grow, until frost occurs. On the varieties at present, the beans in bottom spikes will shatter out b the top spikes are mature. Early vesting of the bottom three to

HULLING and LOADING—In upper left photo castor beans are being hulled and clean beans loaded for shipment at oil mill in California's "DWARF" variety of bean, at left. HARVESTING castor beans after frost on W. C. Austin project, Oklahoma, above. ***Photo above by P. W. George, Region 5, others through the courtesy of the Baker Castor Oil Company.***

ikes on each plant must be done by nd. The burrs are stripped by hand om the spikes and placed in sacks, uch like cotton is harvested. The ter crop can be harvested either by nd or by mechanical castor bean rippers.

Local processing of the beans is mple, and consists of running the burrs rough a huller to separate the beans om the burrs. The huller is owned by e commercial castor bean company, hich also has hullers at McAlester, kla., and Vernon, Tex.

Marketing is simple. The beans are eighed and the farmers are paid at e time of hulling. The hulled beans e loaded in boxcars by the company id shipped to oil mills in New Jersey id California for final processing.

The yield last year under irrigation eraged approximately 1,000 pounds clean beans per acre, an average oss income of $90 per acre at the present price. Some farmers harvested as igh as 2,000 pounds per acre making bout $180 an acre. On nonirrigated nd the yield was from 500 to 750 unds per acre. There are different rieties for irrigated and nonirrigated nd. U S 74 was the variety used on rigated land and Conner was used on onirrigated land. Most farmers say iat castor beans will make them iore money than grain, sorghum, or heat. (See "Castor Beans for Peace or Var," p. 45, March 1951 RECLAMATION ERA.) ●

LETTERS

Many Happy Returns

Please discontinue my subscription, with many thanks for the years I enjoyed the ERA. I passed my eighty-seventh birthday, and do not read as much as I did many years ago. I think the ERA has done wonderful work for the U. S. A.

FRED REMENDER,
Morrill, Nebr.

Somehow we don't mind receiving a discontinuance notice like this.—Editor.

Try and Beat This!

YAKIMA, WASH.
January 18, 1951.

GENTLEMEN: In the January issue of the ERA I have noted a letter from Miss Anna J. Larson of Burley, Idaho. The editorial comment states that Miss Larson has been a subscriber for 34 years, and you ask "Is this a record?"

I was a land holder in the Yakima Tieton project at the time the Tieton Canal was constructed. I was the first Secretary of the Tieton Water Users' Association. I have been a subscriber to the RECLAMATION ERA, formerly the Record, since the magazine was first mailed to the land owners in this project. I am not certain as to the exact year, but think it was 1910. If I am correct this beats Miss Larson's record by 6 years.

Yours truly
(Sgd.) C. H. HINMAN,
606 Hinman Drive,
Yakima, Wash.

P. S. I might imitate Miss Larson by paying my subscription to the ERA 10 years in advance but as I was 80 years old the seventh of this month, I am afraid I will not be sticking around that long. C. H. H.

Beet Pulp Fattens Steers

Bloat in fattening steers can be eliminated by including dry sugar beet pulp in the ration, according to Leo Sinner, who has had 10 years of experience with this feed on his farm in Cass County, N. Dak.

"Ever since I began using pulp," Sinner stated, "I have had no sickness traceable to bloat in my cattle. Beet pulp, pound for pound, has the same feeding value as corn. So, I consider it one of my best feeds when it is no higher in price than corn. However to avoid getting too much bulk I never use it in excess of 20 percent of the total ration.

"Beet pulp is deficient in phosphorus, To compensate for this, I include one-tenth of a pound of bonemeal per steer daily when I am using pulp."—(Reprinted from the October 1950 issue of The Northwest, monthly publication of the Northern Pacific Railroad.)

NOTES FOR CONTRACTORS

Contracts Awarded During February 1951

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Cont amo
DS-3251	Colorado-Big Thompson, Colo.	Feb. 23	One 48,000-hp. hydraulic turbine with pressure regulator and energy absorber for Flatiron power plant.	Pelton Water Wheel Co., San Francisco, Calif.	$274
DS-3256	Missouri River Basin, Mont.	Feb. 5	Structural steel for spillway bridge at Canyon Ferry Dam	Virginia Bridge Co., Denver, Colo.	59
DS-3259	Missouri River Basin, Nebr.	Feb. 7	140,000 tons of crushed rock or gravel blanket material and 300,000 tons of riprap rock for Trenton Dam, schedules 1 and 2.	Cass Co., Contractors, Ogallala, Nebr.	44
DS-3260	Missouri River Basin, S. Dak-Wyo.	Feb. 6	Structural steel for State highway bridge, relocation of State highway (U S 14), Keyhole Dam.	Burkhardt Steel Co., Denver, Colo.	20
DS-3261	Colorado-Big Thompson, Colo.	Feb. 6	One 96-inch butterfly valve with operating mechanism and control system, 2 conduit sections and accessories, and 1 portal sleeve for Carter Lake pressure tunnel, Estes Park-Foothills power aqueduct.	Pelton Water Wheel Co., San Francisco, Calif.	56
DS-3265	do	Feb. 7	Three governors with pumping equipment for regulating speed of turbines at Pole Hill and Flatiron power plants.	Woodward Governor Co., Rockford, Ill.	8
DC-3268	Fort Peck	Feb. 5	Construction of 92 miles of Glendive-Williston 115-kv. transmission line.	J and J Construction Co., Oklahoma City, Okla.	851
DC-3269	Missouri River Basin, Colo.-Nebr.	Feb. 12	Construction of 7 miles of Julesburg tap-Julesburg 115-kv. transmission line.	R. N. Campsey Construction Co., Denver, Colo.	70
DS-3274	Hungry Horse, Mont	Feb. 14	Hollow-metal doors for Hungry Horse Dam and power plant, item 1.	M. Reuter and Sons, Portland, Oreg.	2
DS-3275	Missouri River Basin, Nebr.	Feb. 6	One lot of fabricated steel pipe and accessories, control well, and pipe and fittings for Trenton Dam, item 1.	Eaton Metal Products Co., Denver, Colo.	14
DS-3276	Columbia Basin Wash.	Feb. 28	Six 30-inch welded-plate-steel pump discharge pipes, 3 sections of 54-inch pipe, make up pieces and accessories for Quincy pumping plant.	American Pipe & Construction Co., Portland, Oreg.	2
DC-3304	Riverton, Wyo.	Feb. 21	Construction of buried asphaltic membrane lining for Wyoming Canal, station 1741+00 to 1970+25, schedule 1.	Studer Construction Co., Billings, Mont.	103
DC-3304	do	do	Construction of buried asphaltic membrane lining for Wyoming Canal, station 1980+50 to 2275+00 and 2325+50 to 2560+00; laterals W44.13 and W44.69, schedules 2 and 3.	Lichty Construction Co. and Brasel & Whitehead, Riverton, Wyo.	11
DC-3304	do	do	Furnishing and applying riprap for Wyoming Canal, station 2325+00 to 2560+00, schedule 4.	Gilpatrick Construction Co., Riverton, Wyo.	2
117C-90	Columbia Basin, Wash.	Feb. 1	Completion and paving of 4-lane highway, left switchyard access road, and paving of North Dam crest roadway.	Goodfellow Bros., Inc., Wenatchee, Wash.	29
117C-87	do	Feb. 16	Construction of watermaster office building, storehouse, garages, and general purpose shop at O & M Headquarters, Winchester, Moses Lake, Mesa and Warden, Wash., schedules 2, 3, 4.	Don Williams & Co., Seattle, Wash.	229
100C-114	Deschutes, Oreg.	Feb. 21	Pneumatically applied mortar canal sealing, mile 7 to mile 26, North Unit, Main Canal.	Concrete Elevating & Shotcrete Co., Seattle, Wash.	1
117C-91	Columbia Basin, Wash.	Feb. 16	Construction of residences, garages, watermaster office building, utility building, and facilities at O & M Headquarters, Adco, Wash.	Commercial Builders, Inc., Moscow, Idaho.	163
200C-140	Central Valley, Calif.	Feb. 13	Radio hutments for Mount Oso, Grapevine Pass, Bear Mountain, and Bass Mountain relay stations.	R. E. Ziebarth, Torrance, Calif.	49
300C-8	Davis Dam, Ariz.-Nev.	Feb. 16	Construction of machine and apparatus repair shops at system O & M area.	Daum-Donaldson Construction Co., Phoenix, Ariz.	22
300C-9	do	Feb. 20	Construction of Maricopa substation	George E. Miller, Longbeach, Calif.	32
600C-53	Riverton, Wyo.		Drilling water-supply wells and moving and erecting residences for ditchriders' camps Nos. 9 and 10, and Development Farm, schedules 4, 5, and 6.	Charles M. Smith, Thermopolis, Wyo.	36
604C-20	Missouri River Basin, Mont.	Feb. 8	Clearing part of Canyon Ferry Reservoir	C. L. Hubner, Denver, Colo.	46
710C-165	Missouri River Basin, Nebr.	Feb. 7	Medicine Creek Reservoir development	Northwest Realty Co., Alliance, Nebr.	17
7035-167	Missouri River Basin, Wyo.	Feb. 27	One 1,000-kilovolt-ampere step-voltage regulator for Chadron substation, item 1.	Maloney Electric Co., St. Louis, Mo.	2

Construction and Materials for Which Bids Will Be Requested by June 1951

Project	Description of work or material
Cachuma, Calif.	Construction of 102-foot-high, 290,000-cubic-yard earthfill Glen Anne Dam on the west fork of Glen Anne Creek, northwest of Goleta, Calif.
Do	Four 50-foot by 30-foot radial gates with counterweights for Cachuma Dam.
Do	Two 30-inch hollow jet valves for Cachuma Dam.
Central Valley, Calif.	Construction of about 42 miles of concrete and reinforced concrete irrigation pipelines, 12 to 54 inches in diameter, for Ivanhoe irrigation district, Friant-Kern Canal distribution system.
Do	Construction of 25 miles of concrete and reinforced concrete irrigation pipelines, 12 to 36 inches in diameter, for the Stone-Corral irrigation district, Friant-Kern Canal distribution system, near Seville, Calif.
Do	Construction of 20 miles of concrete and reinforced concrete pipelines, 12 to 33 inches in diameter, for unit 1, Exeter irrigation district, Friant-Kern Canal distribution system, near Exeter, Calif.
Do	Excavation of about 3 miles of tailrace channel on American River, and excavation for penstocks and foundation of Folsom power plant and warehouse area near Folsom, Calif.
Do	Construction of 118 miles of 230-kv. Bonneville Power Administration tie transmission line from Shasta switchyard to Klamath Falls substation.
Do	Construction of a 40- by 140-foot office building, a 40- by 60-foot laboratory and warehouse building, and a 10-car garage at Folsom power plant.
Central Valley, Calif.	5 vertical-shaft turbine-type pumping units capacities of 7 c. f. s., 3.5 c. f. s., 3 c. f. s., and 180 g. p. m. for Exeter irrigation district pum plants E1 and E2.
Do	9 pump manifolds for pumping plants, southern Joaquin municipal utility district.
Do	Main control board extension for four 115-kv. and 69-kv. circuits and 2 transfer breaker panel Tracy switchyard.
Do	Motor control switchgear, distribution switchbo and float switches for southern San Joaquin mu pal utility district No. 3.
Do	6 vertical-shaft, propeller-type pumping units, of 33.3 c. f. s. capacity, for pumping plant N 2 horizontal centrifugal-type pumping units, of 15 c. f. s. capacity, for pumping plant N Columbia Canal; and 2 vertical-shaft, prop type pumping units, each of 5 c. f. s. capacity pumping plant on Mowry Canal, Delta-Men Canal distribution system.
Colorado-Big Thompson, Colo.	Construction of Rattlesnake Dam, a 105-foot h off-stream, 150,000 cubic yard earthfill struc which will have 250,000 cubic yards of rock fi upstream and downstream slopes, and a 1 c. f. s. capacity spillway, 14 miles west of Lovel Colo.
Do	Furnishing and laying Pole Hill and Flatiron p plant penstocks and Carter Lake pressure con

Construction and Materials for Which Bids Will Be Requested by June 1951—Continued

Project	Description of work or material
rado-Big Thompson, lo.	Construction of 2,100-foot concrete-lined Pole Hill Canal and 500 feet of concrete bench flume to carry a capacity of 550 c. f. s. from outlet of Pole Hill Tunnel to penstock inlet at Pole Hill power plant.
Do	One 460-v. and one 125-v. distribution board, two 125-v. battery chargers, two 500-kv.-a. transformers, and one 37½-kv.-a. lighting transformer for Pole Hill power plant.
Do	Generator voltage bus and circuit breaker, including generator protective equipment, for Pole Hill power plant.
Do	Main control board, 115-kv. and 69-kv. circuits, for Beaver Creek substation.
Do	Furnishing and installing steel penstocks for Pole Hill and Flatiron power plants.
Do	Main control boards, distribution boards, battery charging equipment, heating control boards, lighting distribution panel, and station service transformers for Flatiron power and pumping plant and Pole Hill power plant.
Do	Two 6-foot 9-inch by 9-foot top seal radial gates with hoists for Flatiron afterbay dam.
Do	Station-service unit substation and distribution boards for Willow Creek pumping plant.
Do	Motor control switchgear for Willow Creek pumping plant.
mbia Basin, Wash	Construction of 5.5 miles of 2,000 c. f. s. capacity unlined West Canal; Frenchman Hills wasteway and turnout structure; and 3 miles of county road relocation, 20 miles south of Quincy, Wash.
Do	Construction of 17 miles of laterals, 36 miles of sublaterals, 14 miles of drain wasteways, and placing buried asphalt membrane lining for lateral area W-6A on West Canal, south and east of Quincy and Winchester, Wash.
Do	Two 12- by 15-foot radial gates and two 10,000-pound radial-gate hoists for Lind Coulee wasteway; and two 17- by 15-foot radial gates and two 15,000-pound radial-gate hoists for East Low Canal.
Do	Construction of building for housing radio receiving and transmitting equipment at Ephrata, Wash.; and radio equipment buildings at Quincy and Othello, Wash.
Do	Grading and surfacing about 8,000 square yards of driveways and parking areas at Ephrata field office site.
Do	Construction of 96- by 57-foot concrete block major shop building at Quincy, Wash.
Do	10 horizontal centrifugal-type pumping units of 17 to 30 c. f. s. capacities for Babcock pumping plant, lateral W-8 area.
is Dam, Ariz.-Nev	Erection of steel structures and installation of additional electrical equipment for Tucson substation.
Do	Construction of paint shop, washing and greasing rack, vehicle repair shop, service station, storage sheds, and fencing at Phoenix, Ariz., and Parker Dam, Calif.

Project	Description of work or material
Davis Dam, Ariz.-Nev	One 20,000/25,000-kv.-a. autotransformer, one 115-kv. step-voltage regulator, two 115-kv. circuit breakers, 1 station-service transformer, nine 115-kv. disconnecting switches, and three 115-kv. and three 230-kv. lightning arresters for Prescott substation.
Do	Main control board for 230-kv., 115-kv., and 13.8-kv. circuits for Prescott substation.
Fort Peck, Mont	Approximately 35,000 pounds of fabricated galvanized structural steel and pipe for new Glendive substation.
Missouri River Basin, Mont.	Clearing remaining area of Canyon Ferry Reservoir, east of Helena, Mont.
Do	1 main control board, 1 annunciator relay cabinet, one 1,500-kv.-a. unit substation, one 46-volt distribution board, and two 5-kw. battery chargers for Canyon Ferry power plant.
Do	One 9.04- by 9.04-foot fixed wheel gate lifting frame, 1 gate engagement indicator, and 4 gate slot closures for Canyon Ferry Dam.
Missouri River Basin, Nebr.	Construction of 7,500-kv.-a. Ogallala substation.
Do	Construction of 3,333-kv.-a. Chadron substation.
Do	Construction of Franklin south side pumping plant, 5 miles of 45 to 18 c. f. s. capacity unlined Franklin south side canal, and 5 miles of 15 to 6 c. f. s. capacity laterals.
Missouri River Basin, N. Dak.	Construction of 167 miles of 230-kv. steel-tower transmission line between Bismarck, N. Dak., Mobridge, S. Dak., and Oahe damsite, S. Dak.
Do	Construction of 4 miles of Garrison (Fort Peck tie) 115-kv. transmission line connecting Williston-Garrison and Garrison-Bismarck lines.
Do	Furnishing and erecting prefabricated buildings for Bismarck, Devils Lake, and Jamestown substations.
Missouri River Basin, S. Dak.	Construction of 112 miles of Midland-Rapid City 115-kv. transmission line.
Do	Construction of 135 miles of 230-kv. steel-tower transmission line between Oahe damsite and Fort Randall power plant.
Do	Construction of 3,750-kv.-a. Gregory substation.
Do	First stage construction of 10,000-kv.-a. Woonsocket substation.
Do	19,000 tons of fabricated galvanized structural steel for bolted steel towers for Oahe-Fort Randall-Sioux City 230-kv. double-circuit transmission lines.
Paonia, Colo	Construction of headworks and enlargement of 3.3-mile Overland canal, and construction of ½-mile lateral No. 1, northwest of Hotchkiss, Colo.
Rio Grande, N. Mex	Construction of 52 miles of Belen-Willard 115-kv. transmission line.
Do	Construction of 7,500-kv.-a. Willard substation.
Shoshone, Wyo	Construction of Willwood Canal crossing of the C. J. Coulee near Cody, Wyo.

United States Department of the Interior
Oscar L. Chapman, Secretary
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Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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Ruth F. Sadler, *Editor*

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OUR FRONT COVER

Reclamation Street

On the other side of the world, Commissioner of Reclamation Michael W. Straus happened to be strolling through the streets of Hong Kong and came across this sign—a symbol of world-wide knowledge of, and interest in, Reclamation. Read "Reclamation Street—26,000 Miles Long" on page 95 of this issue.

30 YEARS AGO IN THE ERA

ARBORICULTURE

Did you know that Arbor Day is western in its origi
It originated in the fertile brain of one of our most dist
guished and honored citizens, the late Hon. J. Sterli
Morton, of Nebraska. Before the Civil War he was t
owner of a certain barren tract of ground upon which, a
cording to popular belief, not a single tree would grow. B
Mr. Morton believed he knew better. He ordered a consig
ment of trees from the East, planted them, and had t
satisfaction of seeing them thrive. He straightway nam
his home Arbor Lodge, and later, as a member of t
Nebraska Legislature, introduced a bill and persuaded th
body to set aside a day in April for the planting of tre
and shrubs by the citizens.

(From page 212 of the May 1921 issue of the RECLAM
TION RECORD, predecessor to the RECLAMATION ERA.)

RECLAMATION PLACE NAMES IN THIS ISSUE

Salt River Valley Water Users' President Becomes Under Secretary of the Interior

Richard D. Searles, president of the Salt River Valley Water Users' Association, active member of the National Reclamation Association, and prominent Arizona reclamationist, was nominated Under Secretary of the Interior on April 2, 1951, by President of the United States Harry S. Truman. The Senate unanimously confirmed the appointment on April 17.

Mr. Searles is a native of Cedar Rapids, Iowa, and a graduate of Northwestern University School of Commerce. After completing his studies, he spent 15 years with the Fidelity & Deposit Co. of Maryland, and later operated his own company in Chicago, Ill. He moved to Arizona in 1940 where he purchased a ranch near Scottsdale, located on the Salt River project.

This is the Bureau of Reclamation's oldest irrigation and power project, well known as the pilot of all subsequent reclamation developments. Among its principal features are the Roosevelt Dam (named in honor of the late President Theodore Roosevelt, during whose administration the Reclamation Act was passed), the Horse Mesa, Mormon Flat, Stewart Mountain, Horseshoe, and Bartlett Dams.

Mr. Searles immediately took an active interest in the project upon his arrival in Arizona and was responsible for promoting the advancement and improving the operation and maintenance of its power and irrigation facilities including the Reclamation dams plus power plants built by the Salt River Valley Water Users' Association to meet the ever-increasing demands for electric power. He became president of the association in 1948.

Interior's New Under Secretary, Richard D. Searles.
Photo by Abbie Rowe—Courtesy Notional Park Service.

Recently he has served in the capacity of consultant to the Secretary of the Interior. As a representative of the Salt River Valley Water Users' Association he testified before Senate Committees on the use and benefits of artificial precipitation and salt water conversion.

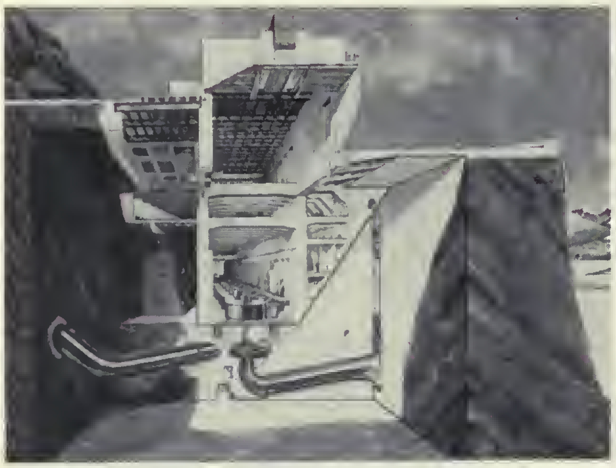
He is married and plans to make his home in Virginia.

IMPORTANT NOTICE TO SUBSCRIBERS

The Office and Project Directory of the Bureau of Reclamation which was formerly printed quarterly and distributed through the facilities of the *RECLAMATION ERA* will no longer be inserted in this periodical. Quarterly issues will be prepared and distributed by the Bureau's Denver, Colo., office. This move was made in the interests of economy. However, *RECLAMATION ERA* subscribers who wish to obtain copies of the four-page directory may do so by requesting them from Chief, Supply Services Division, Bureau of Reclamation, Denver Federal Center, Denver, Colo. The next issue of the directory will be published in June 1951.

The *RECLAMATION ERA* will continue to carry a directory of the Commissioner's staff and regional directors in each issue.

HOW IT WORKS is shown in the cutaway profile drawing. Water enters the pumps from approximately 100 feet below the surface of Franklin D. Roosevelt Lake. Pumps discharge the water into pipes which lift the water 280 feet and empty it into the feeder canal. The pumping plant is almost 15 stories high, but like an iceberg, most of the structure is buried below the surface. *Drawing by the Denver office, Bureau of Reclamation.*



THE BIG LIFT

PRIMING THE PUMPS AT GRAND COULEE DAM

AROUND THE FIRST OF THIS MONTH, the Columbi River will rise above itself.

The Bureau expects a crowd to witness thi historic event, but because of tightened securit restrictions, the general public will not be ad mitted to the world's largest pumping plant whic is making the feat possible. Public ceremonie may be held at the top of the hill approximatel 280 feet above Franklin D. Roosevelt Lake wher the first water will gush from a 12-foot pipe, a the headworks to the Feeder Canal.

Puddling and priming the irrigation networ will continue through summer and fall 1951, an will be resumed in early 1952.

There are settlers who have waited 50 years fo the good news which will be signalled by the sta of the first pump—the irrigation of the Big Ben country in central Washington, starting about 6 miles south of Grand Coulee Dam. The startin of the pump means that water will be availabl to go onto the first 87,000 acres of land in sprin 1952. Ultimately, the Bureau of Reclamatio schedules the irrigation of about a million acres, "new state" in this area, two-thirds the size o Delaware.

The pictures on these two pages show how th huge pumping plant works. Using the ice-ag channel as a storage reservoir makes it possibl during the early years to pump with off-pea power. This will not require power that coul be used by the critical defense industries of th Pacific Northwest. By the time the pumping de mands increase to such a point that one or mor pumps must work steadily during the irrigatio season, additional generator capacity will be i service to more than offset the power diversio

THE ENI

CONNECTING LINKS are shown in the center photo by H. Wayn Fuller. Falling water at the dam generates hydroelectric powe The giant bus bars carry a small part of this power up the le abutment of the dam to the pumping plant behind. By mear of these bus bars, hollow copper tubes, each pair of pump motor is direct-connected to one 108,000-kilowatt generator in the le power house. The photo at immediate left, taken by F. E Pomeroy, shows the casing through which 50 tons of water eac second will pass when the pump is in operation. Ultimately ther will be 12 pumps; 6 are under contract. During the early yea of irrigation off-peak power will be used for pumping.

BEFORE AND AFTER—The world's largest pump is inside the 600-foot-long wing dam, adjacent to the left abutment of Grand Coulee Dam. The first view (above) was taken by F. B. Pomeroy on June 28, 1948, before the Morrison-Knudsen Co., Inc., and Peter Kiewit Sons' Co. started work on their $13,982,593 contract to complete the pumping plant. The after photo (taken by H. W. Fuller on January 17, 1951) shows the structure as it appeared when 95 percent complete.

OVER THE HILL—Columbia River water will climb through the huge pipes shown immediately above. The air photo shows what will happen when the first pump starts at Grand Coulee Dam. The first pump unit, located deep inside the pumping plant (drawn in foreground) will start turning as power feeds from the L–1 generator in the left powerhouse. Water will surge up the discharge pipe, far right on the hill, into the winding Feeder Canal (center of photo). The Columbia River ultimately will fill the Grand Coulee in the background, thereby reentering its ice-age channel, and forming an active storage reservoir for 1,202,000 acre-feet of water. Two earthfill dams, 27 miles apart, will seal the coulee as a reservoir. The first two pumps will require almost 3 months to fill the reservoir to a depth that will push water over the sill of South Dam, thence into the Main Canal which feeds the irrigation project. *Both photos by F. B. Pomeroy, Region 1 photographer; art work by Russ Ducette, also of Region 1.*

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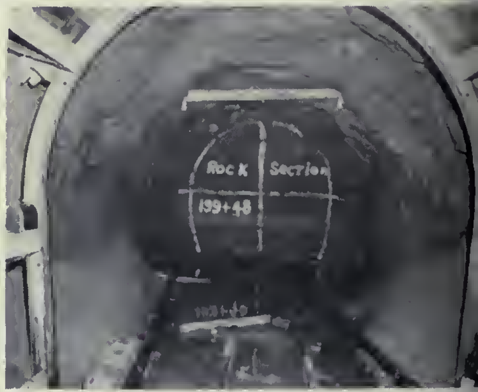
TROUBLESOME TUNNEL—Above, jumbo set-up for drilling in tight spots to install steel supports. Above right, workers' "Subway." Center right, checking the roof. Immediate right, reconditioned tunnel. Next, "Diagram for Destruction." "Diagram" photo by W. Broadfoot, Region 4, "Subway" photo, photographer unknown, others by M. F. Edwards, Region 4.



Difficulties at Duchesne

Punching an 11-foot hole through a 6-mile section of the Wasatch Mountains east of Salt Lake City is grim business—even for the veteran tunnel experts whose amazing exploits a year ago saved the 1950 peach crop for Grand Valley, Colo.

The confident crews of Grafe-Callahan Construction Co., and Rhoades Bros. & Shafner, who came to Utah fresh from their brilliant achievement in Colorado and looking for more worlds to conquer are ready to admit that the Duchesne Tunnel is in a class by itself when it comes to tough construction.

Apparently, driving a by-pass tunnel around a landslide and through hard rock 33 days quicker than anyone dared expect was duck soup compared to piercing the Great Basin Divide. The Grand Valley record-breakers, who were awarded a $4,379,961 contract on September 15, 1949, to complete the Duchesne Tunnel, find themselves fighting to stay on schedule after nearly a year and half of toil, mostly on a 24-hour, 6-days-a-week schedule.

The reasons: the usual construction headaches plus a two-ply humdinger—massive quartzite tha xplodes without powder, and drills out about ve times harder than average rock.

Even with the latest equipment, progress is ittle better (if any) than was achieved more than 0 years ago in driving another 6-mile irrigation unnel near Montrose, Colorado—the Gunnison Tunnel constructed by the United States Reclamaion Service to divert water from the Gunnison River for the irrigation of lands in Uncompahgre Valley. But much of the Gunnison Tunnel was rilled through relatively soft sedimentary formaions. If the old timers had been confronted with he adamant quartzite of Duchesne Tunnel, they night have given up.

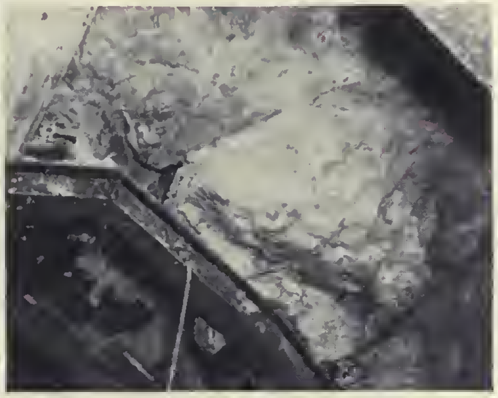
Incidentally, the Duchesne Tunnel, which is ,020 feet longer than the 30,645-foot Gunnison Tunnel (dedicated way back in September 1909 by President Taft), will be second only to Reclamaion's longest irrigation tunnel—the 13.1 mile Alva B. Adams Tunnel of the Colorado-Big Thompson project. It is interesting to note that the three longest tunnels designed primarily to carry water to grow food are located in or close to the Upper Colorado River Basin.

Now slightly more than half completed, the second longest irrigation tunnel is a straight bore designed to bring surplus flows of the Colorado River Basin from the North Fork of the Duchesne River into Deer Creek Reservoir via the Provo River. If fully lined, it can accommodate flows of up to 600 second-feet of water needed to help irrigate 46,000 acres of fertile land between Provo, Utah, and Salt Lake City.

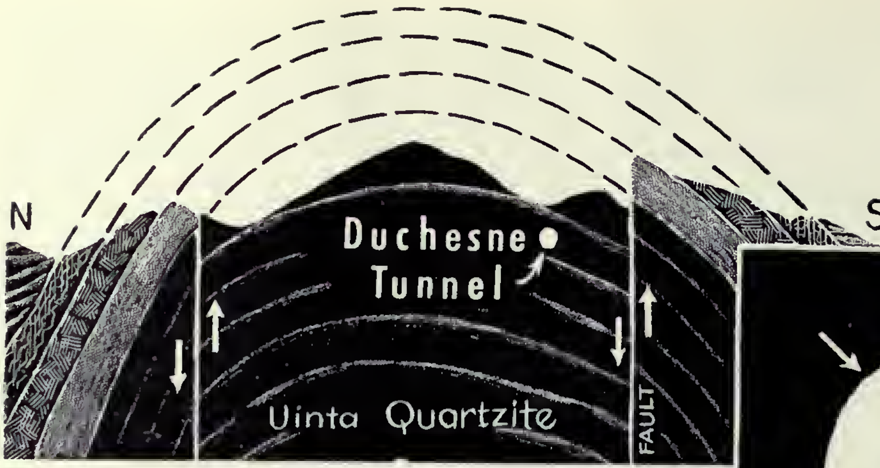
Workers on the Duchesne Tunnel haven't been plagued by carbonic acid gas nor by so great a volume of water as the 2-second-foot flows which delayed construction of the Gunnison Tunnel, but here is what they have had, not to mention some weird moments that space doesn't permit telling about.

This is a one-way job—with the crews digging from one heading only, the west portal. Beginning in 1940, the Utah Construction Company bored more than 2 miles, excavating 12,227 feet of tunnel, continuing until work was halted 2 years later by order of the War Production Board.

During the 7 years that elapsed before construction could be resumed, the weather treated the damp tunnel more severely than anticipated. Practically all of the old timber supports and lagging (protective planks placed between the steel tunnel supports and the rock walls of the tunnel)

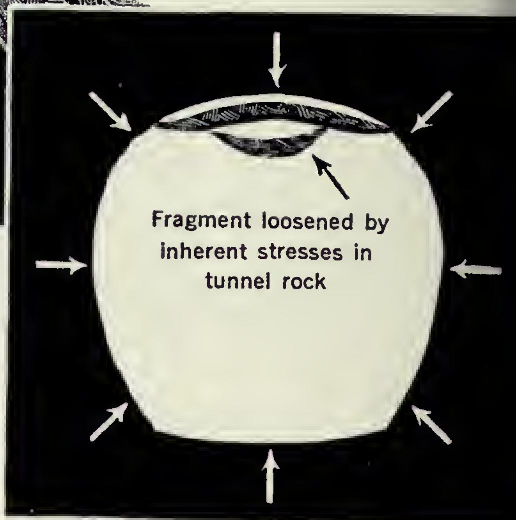


MENACING MOISTURE—Water flowing at the rate of 14 second-feet is 18 inches deep in above photo of tunnel. Above right, Duchesne tunnel, showing cave-in area in old 6-inch steel sets. At right, aerial view of Deer Creek Dam and Reservoir, Provo River project, Utah, which will get water from the other side of the mountain as soon as Duchesne tunnel is completed. *Top photos by M. F. Edwards, right photo by Paul E. Norine, both of Region 4.*



HOT ROCK folded in under great pressure millions of years ago, now hard and cold, is shown above in this artist's drawing of a section of Duchesne Tunnel.

POPPING ROCK today is a resu
of this age-old condition. Th
drawing below is a simplifie
diagram of what happens whe
the rock begins popping.



in the 2.3 miles previously excavated had to be replaced for safety purposes. As a matter of fact, before starting the job, the contractors reconnoitered the diggings and found that the tunnel lagging had practically rotted away.

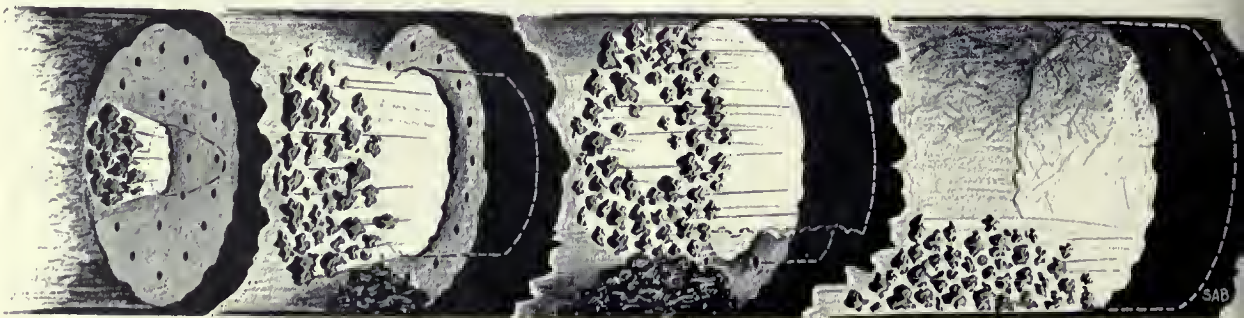
Water flows of up to 2.5 second-feet (1,145 gallons a minute) have been very troublesome. The water pours in from all angles. Weep holes must be drilled to drain off water pockets and relieve the pressure. Water removal has required thousands of feet of 20-inch Naylor pipe, three portable pumps, as well as a stationary pump (2,000-gallon capacity) with a 30-horsepower motor.

At the heading, watery seams acted as conductors and caused one dynamite explosion to start off another, causing practically a simultaneous explosion of all the shots rather than detonations a fraction of a second apart. Farmers will recognize this as another example of how water conducts the jar of an explosion. They often us
only one detonator to explode several charges o
dynamite spaced at intervals along a slough i
order to form a drain ditch or clean silt out of
weir (see "Blast the Silt" on page 25 of the Feb
ruary 1951 issue of the RECLAMATION ERA).

The contractor changed the timing of the blast
from millisecond (fraction-of-a-second) delays t
delays of approximately a second or more betwee
shots.

The Duchesne dynamite crews place the stick
of dynamite in drill holes arranged in concentri
circles, setting off electric detonators with tim

SLOW MOTION MOVIE showing the different phases in a dynamiting operation is represented in this stylized drawing. When the blasts were thrown off schedule at Duchesne by watery seams acting as conductors, a quite different and less orderly explosio
occurred. *This, as well as the drawings at top of page, w
prepared by the Graphics Section based on Region 4 data.*



fuses by one throw of the switch. The dynamite placed in the inner circles goes first, and the blast progresses to the outside circle. Although noisier and much more spectacular, it is reminiscent of what happens when you drop a stone in a quiet stream, and the ripples spread out from the center. What happens in dynamiting, however, is that a cone-shaped hunk of earth is broken loose, the blast beginning at the point of the cone, gathering force and material, and moving to the outer cone. The last shots to be fired are called "lifter" shots at the bottom of the section to be blasted. When the timing of these shots was thrown off by the wet ground, the unscheduled blasts heaved the rock as much as 100 feet back in the tunnel, greatly hampering mucking operations, and tearing out tunnel supports. Loosened wedges which floated in the knee deep water at times derailed the mine cars. Changing the timing (or millisecond delays) approximately a second or more between shots cured the problem in the wet ground. The split-second timing worked satisfactorily in dry, hard rock, producing cleaner breaks and better fragmentation.

Biggest sources of grief, however, have been the phenomenon of popping rock and the hardness of the rock. Although crews have worked around the clock, progress has been slowed to as little as 12 feet in 24 hours as compared to as much as 30 feet in the Palisade Grand Valley Tunnel. On the other hand, the popping rock advanced the heading for a distance of 4 feet at one time. Unfortunately, the contractors cannot depend upon it to pop in the right direction.

Popping rock is not unique, but it was somewhat of a surprise in the massive quartzite of the Duchesne Tunnel. Geologists believe that the rock was folded in under great pressure and at high temperatures, leaving stresses after cooling. When these stresses are relieved by the drill holes, the rock tends to explode by itself. On one occasion, the whole crew was blown off the drill jumbo. Fortunately, no one was seriously injured and scaling crews now go through the tunnel in advance of the drill crew to test the soundness of the area to be blasted.

Depth of drilling had to be reduced from 8 to 4 feet, and 6-inch steel horseshoe-shaped-H beams, placed 1 to 7 feet apart, had to be used to brace the rock right up to the face of the heading in order to alleviate the hazards of popping rock. This has naturally slowed progress and increased costs.

Drilling through quartzite harder than granite is perhaps the chief drawback to progress, taking the job as a whole. The wear on men and steel is terriffic even with modern carbide insert steel bits. Although tungsten-carbide bits are famous for wear, they have to be reground after 12 feet of hammering in the Duchesne Tunnel. It takes a crew from 1½ to 2 hours to drill out a single round as against about 25 minutes in the average tunnel of the same size. Special grinding wheels capable of sharpening 15 bits an hour are helping greatly in this battle of attrition.

Heavy snowfalls have not eased any of the construction problems. Outside the tunnel, mine car tracks have been covered with steel snowsheds clear to the dump. These sheds saved the contractors the almost impossible task of removing snow after each storm.

Obstacles like these have only made the lads who saved Grand Valley's peach crop set their jaws and pitch in all the harder. THE END.

HOLING THROUGH POLE-HILL TUNNEL

FROM EAST AND WEST—They "holed through" Pole Hill Tunnel on March 15, 1951. After the final blast the usual handshakes from those on the two ends of the tunnel were exchanged. D. E. Cortee, hard-rock miner who helped set off the final blast, receives his handshake from J. H. Knights, district manager, Bureau of Reclamation. Looking on are (at extreme left) Robert Barkley, engineer, Northern Colorado Water Conservancy District, Greeley, Colo., J. M. Dille, secretary-manager, northern Colorado Water Conservancy District, Fort Morgan, Colo., Ren Read, assistant district manager, Bureau of Reclamation, and an unidentified miner. At the extreme right is K. W. Dickey, Bureau of Reclamation field engineer. The Wunderlich Company was the contractor for drilling the 5.6 mile tunnel, part of the Colorado-Big Thompson project, in record time. They started work in September 1949, and holed through in 75 percent of the time anticipated for this part of the job. *Photo by N. T. Novitt, Region 7 photographer.*

DESCHUTES DOES IT AGAIN

When it comes to growing prize-winning ladino clover seed, Jefferson County farmers living on the 50,000-acre North Unit of the Deschutes project, one of the Bureau of Reclamation's newest developments in Oregon, have practically a monopoly. In the November 1949 issue of the Reclamation Era we told how these farmers grew prize packages of clover seed in the article, "Deschutes Project—Deep in Clover." Last year returns from three major fairs in which growers had entered their ladino seed again confirmed their supremacy. Their 1950 accomplishments include firsts at the Oregon State fair at Salem, the International Livestock Exposition at Chicago, and the Royal Winter Fair at Toronto, plus a liberal number of lesser awards.

At the Oregon State Fair in Salem, North Unit farmers J. D. Welch, Jr., and Jim Brooks, took first and second prizes, respectively. At the big International Livestock Exposition in Chicago, the first and second place awards went to A. M. Pluemke and Lester Fletcher, respectively. The Royal Winter Fair in Toronto offered six prizes, all of which were taken by North Unit farmers. First prize went to J. D. Welch, Jr.; A. B. Starnes, second; Pete Bicart, third; Wiley Clowers, fourth; Lester Fletcher, fifth; and A. L. Clowers, sixth.

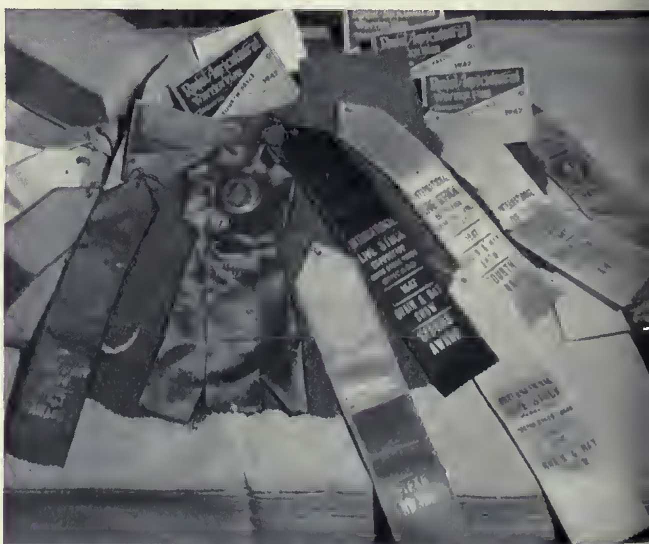
North Unit growers further added to their laurels in red clover competition also, with their Kenland Red samples scoring at Salem, Chicago and Toronto. Recipients of prizes in this competition were at Salem, Jake Kollen, second prize; at Chicago, A. M. Pluemke, second; Lester Fletcher, fourth; and Ted Sleasman, eighth; and at the Canadian fair, Roy Stevenson, third; Lester Fletcher, ninth; A. L. Clowers, tenth; E. B. Randolph, twelfth; and Wiley Clowers, fourteenth.

Water was first delivered to North Unit land in May 1946.

Ladino seed growers on the North Unit will long remember the fall of 1950 as one which almost cost them one-third of their seed harvest. Before the 1950 seedings and a substantial part of the older seedings could be harvested, the project area was lashed by heavy rains, severely damaging the Ladino clover seed crop and raising havoc with harvesting operations.

Through their hard work and ingenuity, the farmers finally overcame Nature's blow. They

RESULTS and REWARDS—Tom Miller examines Ladino clover on his irrigated farm near Metolius, Oreg. Ribbons were won for quality seed at expositions, fairs and other major events. *Photos by Stanley Rasmussen, Region 1 photographer.*



ran the moisture laden crop through their combines and thrashers over and over until they had extracted a substantial yield and salvaged most of the crop. The harvest lasted until January 1951.

That their labors were rewarded is evidenced in the North Unit crop census for 1950, which reveals that the 16,136 acres of Ladino clover seed yielded 37,852 bushels, an average of 2.3 bushels per acre. This is still a good yield on most Ladino clover seed producing areas, but is considerably below previous yields on the North Unit.

Total value of the crop was $2,838,900, or a gross per-acre average of $175.94. THE END

California Farm Corporation Agrees To Dispose of Excess Land

Officials of Re-Al Farms, Inc., a San Joaquin Valley farm corporation, signed a contract on March 29, 1951, in which they agreed to dispose of all land in excess of 160 irrigable acres under provision of Reclamation law.

Under the contract, Re-Al Farms, in the Panoche Water District west of Fresno, agreed to dispose of excess acreage at a price determined by an appraisal board.

Under Reclamation law, an owner can receive Central Valley project water for only 160 acres of his holdings, unless a recordable contract is signed. Re-Al Farms, Inc., agreed to dispose of about 1,200 excess acres in the Panoche district. The contract allows the company ten years to conclude the sales.

The appraisal board is composed of three members, one appointed by the Bureau of Reclamation, one by the water district, and a third to be selected by the first two members. Under the contract either party can call for a reappraisal at any time before the final sale.

By signing the recordable contract for ultimate sale of the excess acreage, the entire Re-Al Farm acreage was made eligible to receive Central Valley project water. •

Hungry Horse Due for Round-Up

Secretary of the Interior Oscar L. Chapman announced on March 16, 1951, the award of a Bureau of Reclamation contract to complete Hungry Horse power plant. The Grafe-Shirley-Lane Co. of Los Angeles, Calif., won the contract for the installation of four giant 105,000-horsepower turbines and governors, and for the completion of the power plant and switchyard at Hungry Horse Dam on the Flathead River near Kalispell, Mont.

The hydraulic turbines are being manufactured by the Allis Chalmers Manufacturing Co. of Milwaukee, Wis., the four generators are being furnished and installed by the General Electric Co., Schenectady, N. Y., and governors for the power units are being provided by the Woodward Governor Co. of Rockford, Illinois.

Under the contract, the first of the four 105,000-horsepower turbines must be installed in time for the first 71,250-kilowatt generator to go on the line by October 1952. •

Second Annual Construction Engineers' Conference

Bureau of Reclamation construction engineers—the men who direct millions of dollars worth of Government field construction work each year—convened at the Denver Federal Center during the week of February 12–16 for the second annual construction engineers' conference on progress and problems in Reclamation construction.

The Bureau's Branch of Design and Construction in Denver, under the direction of Chief Engineer L. N. McClellan, was host to the gathering of about 60 of these top construction engineers.

During the week-long conference the problems of contract administration, labor regulations, equipment and machinery installation by contract, and other matters relating to the Bureau's contractual responsibilities were subject to critical review and open discussion. Engineering seminars on new developments and design, materials, and construction methods were also held for the program participants.

Emphasis this year was placed on construction quality, economy, and concentration of work to speed production of additional hydroelectric power and irrigation needed for the defense effort.

In addition to the construction engineers, representing virtually every important Reclamation project in the 17 Western States, several officials from Reclamation's Washington office also attended the conference, among them Assistant Commissioner Goodrich W. Lineweaver; T. W. Mermel, engineering assistant to the commissioner; K. K. Young, of Mermel's staff; Director of Supply S. W. Crosthwait, and Programs and Finance Director A. R. Golze.

Discussions by Washington officials included addresses by Ansbert C. Skina, chief of the construction expediting branch of the Defense Power Administration, and George Atkinson of San Francisco, Calif., president of the Guy F. Atkinson Co., representing the Associated General Contractors of America. Mr. Skina outlined the situation regarding defense orders and the increasing shortages of materials.

Mr. Atkinson, who spoke on "Engineer-Contractor Relationships," told the conference he was pleased to note continuous improvement in relations between contracting agencies and contractors. In a frank discussion of the virtues and faults of various contracting agencies, he commended the Bureau of Reclamation for saving probably several million dollars during the last few years by improving its construction specifications.

Assistant Commissioner Lineweaver discussed the impact of the current emergency on the Bureau's construction program for the next fiscal year. He pointed out the likelihood of the program being keyed to power production and of the continuance of important irrigation work. He reminded the engineering conferees that the budget request affecting Bureau work in the 17 Western States is subject to decisions of congressional committees, but he could not predict what action they will take. The request is for a total sum for construction of about 225 million dollars, about 100 million dollars smaller than this year's request for construction appropriation. About 30 millions more is being requested for the Bureau for operation and maintenance, general investigations, and general administration.

The construction engineers' conference, like the first of its kind held here a year ago, was called at a time when field construction activities are at their lowest point because of weather conditions. THE END.

BETWEEN SESSIONS—D. S. Walter, Bureau regional engineer at Boise, Idaho (extreme right), relates an amusing incident to fellow conferees at the construction engineers conference. Shown with him are (left to right): C. H. Spencer, construction engineer at the Hungry Horse Dam, Mont.; W. A. Dexheimer, Assistant Chief Construction Engineer, branch of design and construction, Denver, Colo.; and R. K. Durant, construction engineer, Friant-Kern Canal distribution system, Central Valley project, Calif.

Lebanon Receives Point 4 Assistance From Reclamation Mission

A 10-man Bureau of Reclamation mission left the United States for Beirut on April 15 to help the Republic of Lebanon in the solution of its economic development problems. The mission will make a three-month reconnaissance study of Lebanon, a country about the size of Connecticut, lying north of Palestine on the eastern edge of the Mediterranean. Over a million people live in this 4,000-square-mile area, two-thirds of them in rural areas.

The mission will survey the 125-mile-long Litani River and its drainage basin, which has been called the "bank reserve" of Lebanon, examine potential dam sites, classify potentially irrigable lands, and determine the needs for water. The mission will also recommend action to reduce water pollution in the basin area, and will make a study aimed at a malaria-control program.

This project is the first phase of a cooperative Point 4 economic development plan, financed by the Technical Cooperation Administration, Department of State, which administers the Point 4 program under the International Development Act. The purpose of the plan is to help Lebanon increase both its industrial and agricultural output and raise its living standards.

The project is headed by Robert F. Hardman of Hardin, Mont., and includes Arthur F. Johnson, Mortimer R. Lewis, Ralph E. Winchell and Martin H. Fresen of the Bureau's Washington, D. C. office; Sumner B. Foster, Robert M. Ancell, and Eugene Wagonner from the Bureau's Engineering Center, Denver, Colo.; William W. Gorton from the Bureau's Boise, Idaho office; and Frederick Carlyle Roberts, Jr., of the United States Public Health Service, Dallas, Tex. •

SWAPPING KNOW-HOW—Former reclamation trainee, Dr. V. Amanda Raa, supervising engineer of the Irrigatian Department af the Madras Public Warks Department of India, paints out engineering developments at an outdoor laboratory In Poondi, India, to United States Reclamation Commissianer Straus.

Commissianer Michael W. Straus and Chief Engineer L. N. McClellan of the Bureau af Reclamatian were twa af the United States delegates at five international conferences held in India last January: A meeting af the Internatianal Association for Hydraulic Research; a regional conference on Flaad Cantral af the Economic Commission for Asia and the Far East; the World Power Canference; the Conference an Large Dams; and the International Commission an Irrigation and Drainage.

A total of 770 persans, 430 Indians and 340 from ather cauntries, registered at these canferences.

Besides the many technical and afficial repaorts they are preparing as results of their trip, Mr. Straus has written a general accaunt which will shortly be available through the Bureau af Reclamation, Denver Federal Center, Denver, Cala., attention 841. This account will include a summary by Mr. McClellan of the events and discussians at the conferences themselves.

RECLAMATION STREET— 26,000 Miles Long

by MICHAEL W. STRAUS, Commissioner

Bureau of Reclamation

While battles rage and soldiers die, the oldest, bitterest war of all, whose casualties and misery have been inflicted on uncounted millions of human beings, is reaching an acute stage. It is the war of man against Nature for the means of survival.

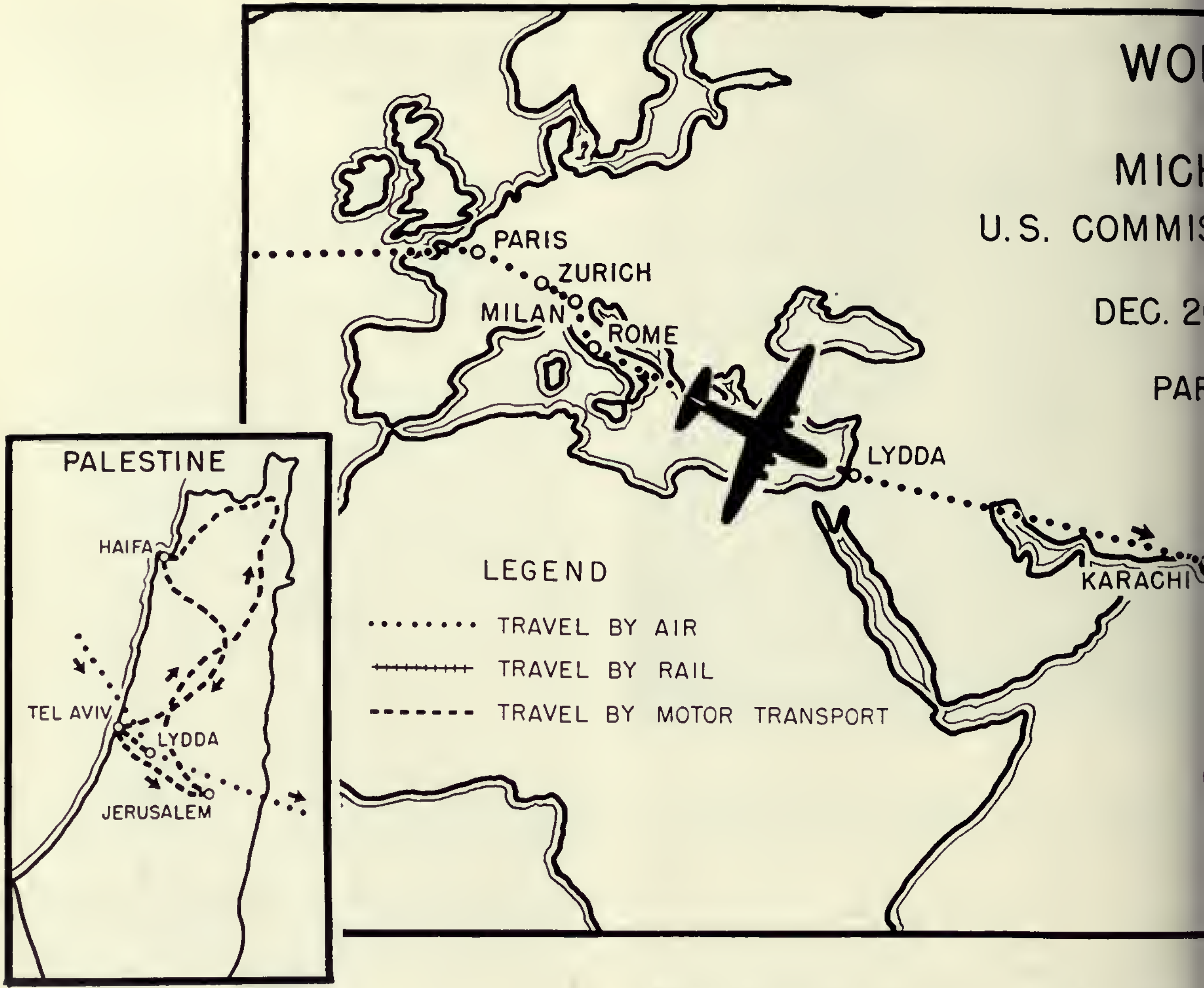
The earth's population is swiftly increasing. The rate of growth multiplies with the years. Yet means of feeding and clothing this new population lags far behind in the race with the birthrate. The results are starvation, exposure, disease, and unrest over large areas of the earth. Hunger has become the ally of tyranny.

But as America sends military aid to the defenders of liberty over land, sea, and air, so it is sending technical aid to help the teeming peoples of the under-developed areas win the war against want.

Vast reaches of these under-developed areas lie in the arid belt stretching round the globe—where deserts await only sweet water to grow food and clothing.

We are now helping to build a broad highway where once existed but a dim trail, marked by the green of irrigated crops round the arid belt of the world, and we can call it "Reclamation Street." We know it from Nebraska to California, in the United States, but it stretches on—26,000 miles round the globe.

On travels around the world this winter, I followed "Reclamation Street" through Italy and Israel, through Pakistan, India, and Ceylon, through Siam and Hongkong, the Philippines, Guam, and Hawaii. I found it perhaps better known on the other side of the world than in some of the eastern States of America.



I even found a symbolic sign reading "Reclamation Street" in English and Chinese, in the back washes of Hongkong.

I came to realize that the Bureau of Reclamation is something more than a regional domestic governmental subagency which helps to bring greater prosperity and opportunity to seventeen water-short Western States. American Reclamation achievements have inspired hope all over the earth among peoples struggling against crushing odds to win some scant measure of decent well-being through their own efforts.

The people of the Far East have known the benefits of simple, and sometimes excellent, irrigation since the dawn of civilization. During uncounted generations they have been learning things which we only now are gratefully adapting to our own use in the American West.

More recently, those people have come to realize how modern, multiple-purpose projects, including the generation of hydroelectric power could win them more acres, increase their yields, and help them make or buy the many things they need. For technical help and knowledge in planning, building and operating such projects, they are turning to us of the American Reclamation movement.

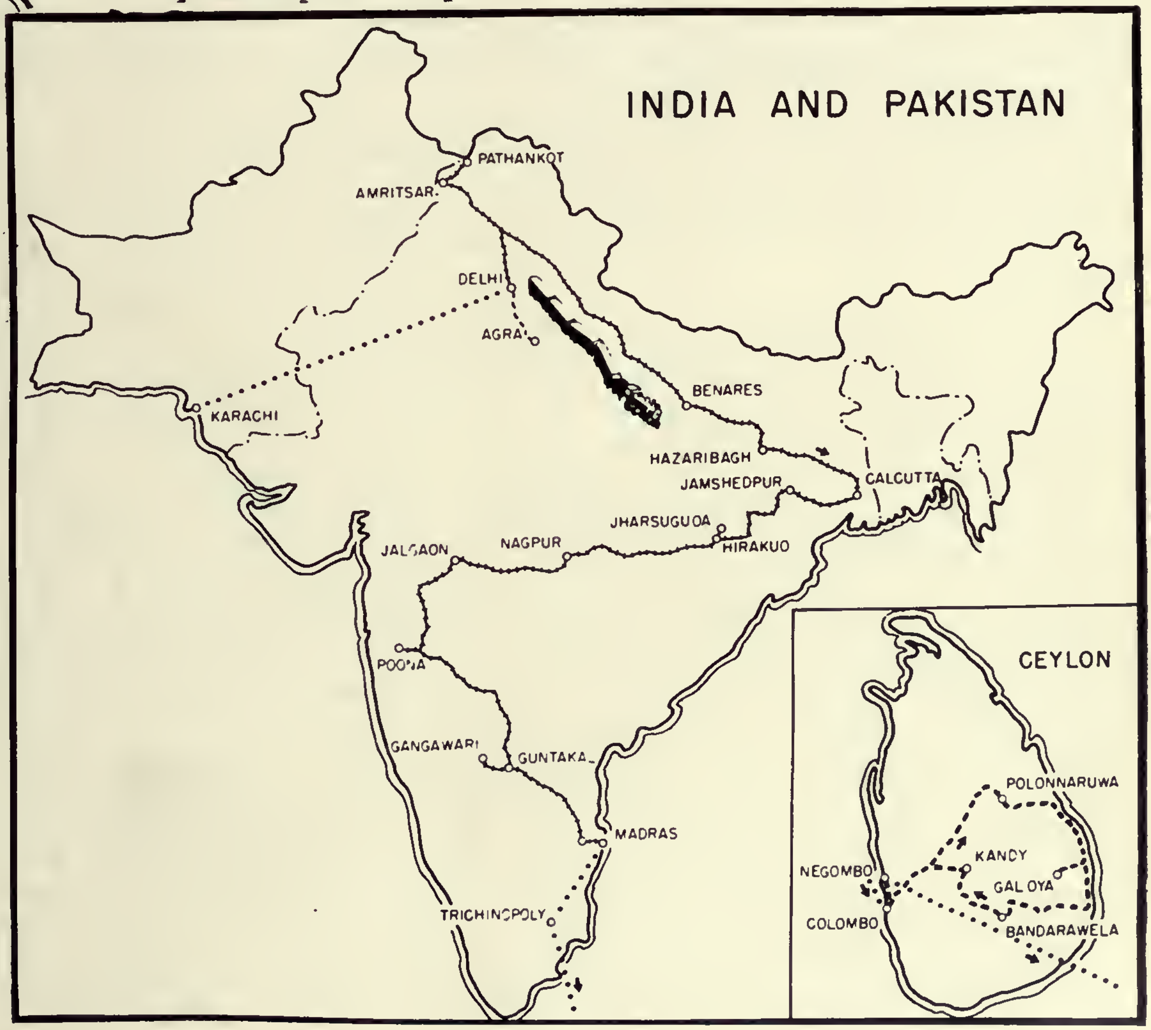
We are eagerly supplying this technical help and knowledge, and find many of these countries equally eager to pay for the costs, within their means to do so. We find, too, valuable extra reimbursement from the technical knowledge we gain from the centuries of irrigation experience in many of these nations.

Through the Economic Cooperation Administration, the Department of State, and President Truman's Point Four program, the Bureau of Reclamation is making its publications and re-

searches available world-wide; has sent expert consultants to many undeveloped corners of Europe, the Near East, and the Orient; has trained 200 young engineers from 21 different Nations; performs special tests and researches; and makes its considerable resources of modern engineering know-how available to those who sorely need them.

Naturally, the American program comes first. The aid we give to other nations is all paid for by non-Reclamation funds, and is confined to what we can do without interfering with our own work in the West. The Bureau of Reclamation can perform only a fraction of the services that other nations would like to have from us.

Even that fraction, however, can constitute a significant contribution in the world's warfare against want. For our technical assistance falls like seed on fertile and receptive soils and yields manifold returns.



OUTDOOR LABORATORY in the Province af Madras, India, under inspectian by Cammissianer Straus, followed by Dr. Raa, and two other former trainees in reclamatian, who are naw leaders in Indian design engineering. Many irrigatian and engineering techniques developed in India have been most useful ta engineers in the United States and other countries.

On my trip, I found all South Asian countries embarking upon programs for developing their natural resources, and giving water and power developments first priority. They have the land, the water, the labor, the skill, and the determination. They lack money, equipment, and some kinds of training and technical knowledge. Though they are launching ambitious, forward-looking programs, it will be many decades before they have enough food, water and power to meet the minimum needs of their ever-increasing populations. Despite handicaps, they work courageously with what they have. They are trudging down Reclamation Street with their eyes fixed on distant goals.

The Reclamation Way in Italy

In Italy, almost 300 million dollars in the form of counterpart funds set aside by the Italian government to match American ECA aid, has been made available for water and power developments. Though little of this money has been put to use so far in actual construction, some worth-while projects in the Po River Valley, Sardinia, and Sicily have been designed and approved. One American ECA official closely in touch with the Italian program is Edward Corfitzen, formerly a Bureau of Reclamation engineer.

In Israel, it is not too much to say that this new nation's economy will stand or fall on its success in developing the waters of the Jordan River. Before Israel was created, and while the region was still under the British-Palistinian Mandate, the Bureau of Reclamation helped form a project plan for this river basin. However, the boundaries drawn between Israel and the surrounding and unfriendly Arab States have brought work on this plan to a halt. Hydroelectric developments already built lie in Arab territory and have been cut off, and at least partly wrecked, on the Arab side of the boundary. The Israeli are doing what they can through intensive water conservation measures and development of ground-water supplies; but their economy will continue to be precarious until and unless some way can be found to end disputes and develop the wasting waters of the Jordan.

Pakistan is another new nation born of battle; its boundaries drawn by truce with no regard to the geographical integrity of river-basins. Its 75 million people depend largely upon irrigation for economic survival, and its principal water resource is the great Indus River. However, some of the principal tributaries of this river arise in India.

Since bitter and still unresolved conflicts exist between these two new nations, the Indians are in a position to cut off the water from vital areas in Pakistan. Pakistan has completed excellent irrigation developments, some of them outstanding for their remarkably fine hydrology; however, its officials freely recognize that much more irrigation and power development is needed to establish a firm economy. If they could afford it, they would like to have help from the Bureau of Reclamation covering virtually every aspect of the Reclamation field.

Reclamation has already helped India by training many of her most outstanding engineers. As a result, Indians look principally to the United States for models of resource development, and they are eager to send us still more trainees and to have as much as they can of our technical aid.

(NEXT MONTH—FROM INDIA TO THE UNITED STATES)

Sumner P. Wing, Foreign Activities Leader, Dies Unexpectedly

Sumner P. Wing, who for the past 4 years has been in charge of foreign activities programs of the Bureau of Reclamation and who was preparing to personally lead an engineering team on a Point Four mission to Libya, died unexpectedly on Thursday, March 22, 1951, at the Group Health Association office, 1328 Eye Street NW., Washington, D. C. He was 60 years old and resided at 2801 Adams Mill Road.

Mr. Wing had been an engineer with the Bureau of Reclamation for 21 years. Since 1947, when he was appointed special representative to cooperate with the State Department, he served as liaison officer with irrigation representatives of foreign nations. The Reclamation program of engineering information and personnel exchange with the foreign governments has since been incorporated into President Truman's Point Four program.

Before coming to Washington, Mr. Wing was stationed at Denver, Colo. While there he was also active in foreign relations activities, winning a meritorious award for "establishing a closer working relationship and international good will between the Bureau and foreign governments who have had representatives working in or visiting this office." He had carried out a variety of domestic Reclamation engineering assignments, among which was work on the plans for the diversion tunnels and spillway bridges at Hoover Dam.

Prior to joining Reclamation, he was chief civil engineering designer and assistant to the chief engineer of the British Columbia Power Corporation for several years. He had also done engineering work in Italy and Korea. He was a member of the American Society of Civil Engineers and numerous other professional societies.

Born in Ithaca, New York, February 28, 1891, he was graduated from Stanford University and served as an engineering officer in the United States Army in World War I. He was the son of the late Charles D. Wing, formerly professor of structural engineering at Stanford University, Palo Alto, Calif.

From the State Department came the following message to Commissioner Straus from William C. Johnstone, Jr., Director of the Office of Educational Exchange:

> Members of my staff and I were distressed to learn of the sudden death of Mr. Sumner P. Wing. Those of us who have had the privilege of working with your office always found Mr. Wing a fair, understanding, and cooperative officer to deal with.
>
> We share with you the loss of a man who gave unstintingly of his talents, both as an engineer and as a Government official, to create a better world to live in; and who through his belief and actions championed the cause of international neighborliness and understanding.

L. N. McClellan, the Bureau of Reclamation's Chief Engineer, paid tribute to Sumner P. Wing in these words:

> The death of Sumner P. Wing was a shocking surprise to me and to all of us who had worked with him so long and with such great fondness.
>
> Sumner Wing came of a cultured background and was truly a gentleman, a fact which reflected itself in everything he did. We have lost a good friend. More than that, the loss to the Bureau of Reclamation is greatest because we are deprived of the services of a man who had profound knowledge, personally gained, of other peoples and other lands.
>
> While in charge of the reference library and of foreign activities in the Denver offices, Mr. Wing displayed genuine affection for the foreign visitors and trainees who came to his desk, extending himself generously to look after not only their technical or professional inquires but also their entertainment.

Mr. Wing's loss was described as a severe blow by Commissioner of Reclamation Michael W. Straus, who issued the following statement:

> The sudden and unexpected death of Sumner P. Wing is a loss not only to Reclamation development in the United States, but to irrigation and power development in many nations. In his long engineering career he performed outstanding services, but in recent years as administrator of many of the foreign contracts of the Bureau of Reclamation he became the friend and assistant of engineers in 20 foreign countries.
>
> Men who deal in water and power and the development of natural resources, regardless of race or color, as they came to this country seeking American aid, found their way to Mr. Wing's office in the Bureau of Reclamation. He gave unsparingly of his time and energy to helping them with their problems, securing for them the technical information that they wished and, in many instances, setting up missions from America to help them carry out their work in distant lands. He took a deep and almost paternal interest in the welfare of half a thousand engineers from overseas who in the last quarter of a century have come to take trainee courses with the Bureau of Reclamation.
>
> Mr. Wing's passing will be a sorrow to professional colleagues working to develop water of all continents, but a lasting monument to his endeavors are the structures that those he helped have built and will continue to build to serve mankind. ●

SHORT CUTS TO WEED-KILLING CALCULATIONS

PART TWO—Finding the Killer in the Dust

This is the second in a series of articles based upon the bulletin, Handbook of Weed-Control Calculations, prepared by John T. Maletic, soil scientist and weed specialist of the Bureau of Reclamation's Region 7, headquarters at Denver, Colo. In part one we explained how to use Figure 5 in the Handbook, which was entitled, "Nomogram for Determining the Cost of One Pound of Active Ingredient in Liquid Herbicides" which can help you get the most for your money when you are buying liquid weed killers.

Here is figure 4 from the handbook. Despite the imposing title, "Nomogram for Determining the Cost of One Pound of Active Ingredient in Solid Type Herbicides," this is a handy chart to help you find the "killer" ingredient when you buy a powdered herbicide or weed killer, such as 2,4–D, TCA, or a chlorate. This chart may also come in handy if you are buying a can or drum of insecticide or fungicide—but only if one principle active ingredient (or the part that does the killing) is involved. All-purpose chemicals for controlling insects or plant diseases, or both, contain several active ingredients and therefore this nomogram would not be applicable.

Now let us suppose you have made your plans to dust a weed-infested area, or insect- or disease-infested crops. Perhaps you are going to dust by airplane. (If you are using 2,4–D, you would of course keep in mind the fact that dusting 2,4–D by plane is frowned upon because of the danger of it drifting to cropland, and this practice is prohibited by law in many States. This problem is now being studied and some progress has been made in using pellets of 2,4–D, to bombard the earth before plants have appeared. Pelleting 2,4–D eliminates the danger of drift.) Perhaps you plan to use a dusting or blowing machine which will blow dust on the growing plants, at whatever angle you have decided is best—depending upon the set of the dusting nozzles. Or you may plan to use a spreader, the same machine you use for applying lime or fertilizer, for dusting the ground and preventing weeds from appearing at all.

For the sake of illustration, let us suppose you have decided upon 2,4-D for your job. You will not be able to find a can, bag or drum of concentrated powder which contains 100 percent active ingredient—for the simple reason that it costs too much to refine the chemicals, and furthermore you could not spread it around on your crops or land. As in liquid herbicides, the solid types often have materials in them, such as talcum, powdered clays or other solid materials, called "carriers," which are not harmful or toxic to plants, but which break up the active ingredient so a small amount can be spread evenly over a large area. You would not want to use an herbicide, insecticide or fungicide full strength, nor would you be able to do so.

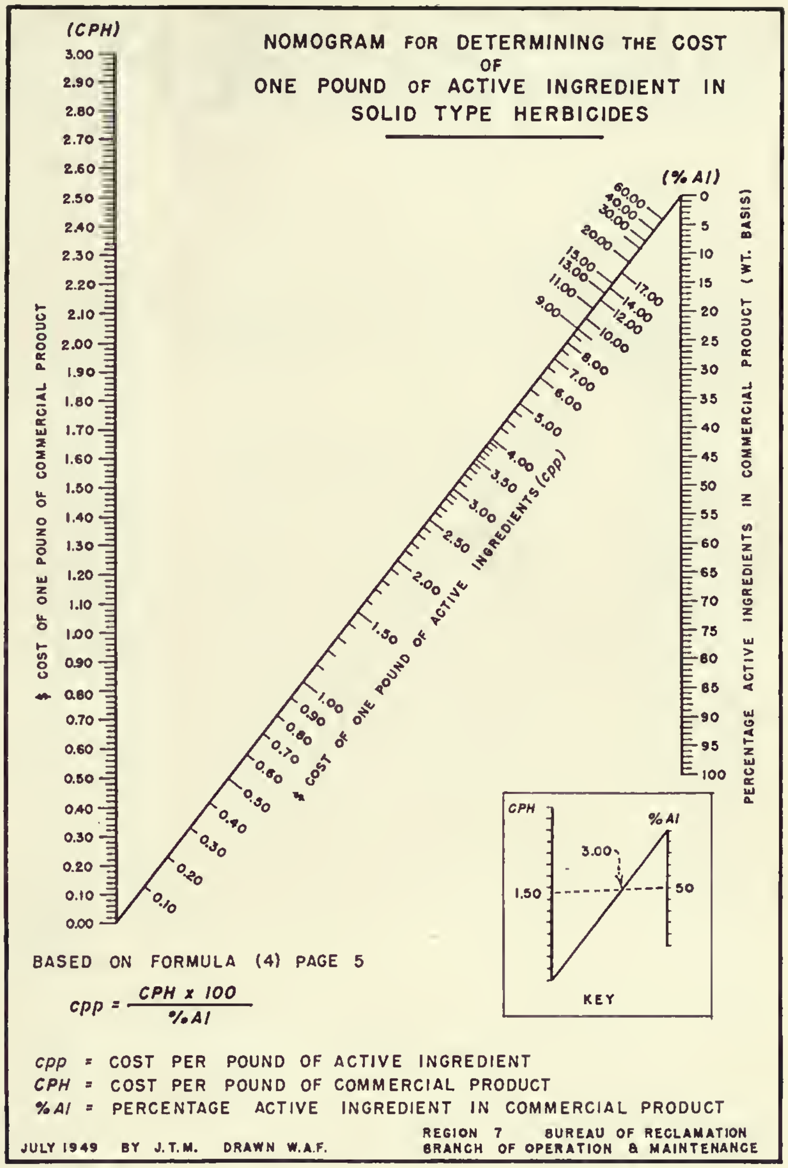
Therefore, what you want to find out is how much you are paying per pound for the chemical which is actually doing the job for you—the active ingredient.

For your convenience, we are having this series of nomograms reprinted, and you may obtain them upon request from your nearest Bureau of Reclamation Regional Director, or the Commissioner's office in Washington, D. C. So when you go to the store, you may have this nomogram tucked in your pocket, ready for your use in comparing the prices and active ingredients of the various brands and packages.

The left hand vertical scale of the nomogram is headed CPH (which represents the cost of one pound of the commercial product). The reason for using the initials CPH rather than CPP for Cost Per Pound is to avoid confusion. The answer you are looking for is CPP—cost per pound of active ingredient. Think of Cost Per Herbicide (or Insecticide or Fungicide, if you can use this chart for that purpose) when you look at the left-hand scale on the nomogram, and of the price tag converted to the cost per pound of the commercial product.

The right hand scale, headed % AI, of course means percent of active ingredient in the commercial product on a weight basis. You can easily figure out the cost per pound of the 2,4-D, and the label should tell you what percent of the dust or powder in the container is "active ingredient."

RAPID CALCULATION METHOD—In John T. Maletic's "Handbook for Weed Control Calculations" on page 96, he explains the use of nomograms like the one at right. Alinement charts like these afford a convenient method of making weed-control calculations. The principal advantages of the nomograms are the rapidity and simplicity with which the calculations can be made. Unskilled individuals can perform computations with a nomogram as readily as anyone. Because of the wide range of values involved in the nomograms precise answers should not be expected. The nomograms reproduced in this series will therefore give approximate answers which are within the limits of accuracy obtained by the actual field applications of the herbicides. In using the charts, scales can be more easily read if a transparent straightedge is used. For accuracy the straightedge should always precisely intersect the value involved.



Now, to find out how much one pound of the actual active ingredient costs, you catch the figure on the slanting line, between the two figures you already have.

Suppose you find that a 10-pound package of 2.4-D costs $15. That would make it $1.50 per pound. Now you have the figure for the CPH column. The label states that the package contains 50 percent active ingredient. Merely place one end of your straightedge precisely at the $1.50 of the CPH scale, and slide the other end around until it is precisely at 50 on the right-hand scale—percent AI. If your straightedge is aligned properly, it should intersect the diagonal line at 3. Your active ingredient costs you $3 per pound.

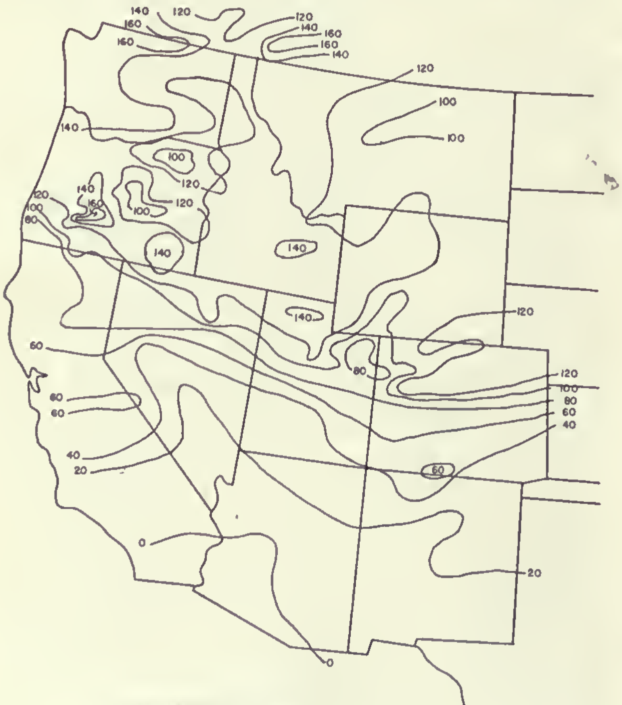
Another brand of 2.4-D costs only $14 for 10 pounds, or $1.40 per pound (CPH), which might seem cheaper. But the label states that it contains 30 percent active ingredient. When you connect the figures 1.40 on the CPH scale and 30 on the percent AI scale, take your pencil and make a dot where the straightedge crosses the diagonal line. You will find it halfway between 4 and 5, which means your active ingredient is costing you $4.50 per pound. You would have to use considerably more of the second product to get the same results, and it would cost more in the long run. Buying the $15 bag of TCA with the 50 percent active ingredient would really be cheaper and more effective than buying the $14 bag with the 30 percent active ingredient. ●

WATER REPORT

OUTLOOK FOR 1951 WATER SUPPLY OF THE WEST

by CLYDE E. HOUSTON, Irrigation Engineer, Soil Conservation Service, Reno, Nev., and R. A. WORK, Senior Irrigation Engineer, Soil Conservation Service, Medford, Oreg.

This year the pattern of plenty or little (water, that is) covers the West like a variegated quilt. The old, and never settled, question of weather cycles again has popped up. When will the Southwest drought relax its damaging and expanding grip? Will nature continue her generous water gifts to Columbia's fertile basin? The writers venture no opinions as to long-terms answers to such vital questions. However, it might be interesting to recall that Sir Francis Bacon in his writings of 1625 AD referred to a 35-year weather cycle. Douglas, a very able research student, identified a master 270-year weather control cycle which he said contained sub-cycles, one rather strong, of 14 years. Gillette, from his silt-layer studies of ancient lakes, asserted existence of a rigid 152-year rainfall cycle. Harding, from his ingenious studies of inflow to land-locked lakes, concluded exact weather cycles to be unpredictable, but of course conceded the well-known existence of alternating periods of scanty or copious precipitation. Thus, in general, it seems that skilled interpreters of historical precipitation records fail to agree. How, then, are we laymen to project nature's past performances dependably into the future?



PROSPECTIVE STREAM FLOW
APRIL-SEPTEMBER, 1951
FIGURES ARE PERCENT OF 1940-1949 AVERAGE

Well, the snow surveyors conservatively project nature's performance during the winter months into usable and dependable forecasts of water supplies for the following irrigation season. That seems to be about as far as science today can successfully carry us, in lifting the veil from the hydrologic future.

So let's see how the snow surveyors size up the immediate prospect for 1951.[1]

In the following paragraphs the water supply outlook is reviewed State by State.

ARIZONA—Arizona is entering its main irrigating season with one of the poorest outlooks for water in almost a half century of record. Streams flowing into the major reservoirs of the State have carried miserly base flow during the entire runoff season. The reservoirs of the State now store water only to 7 percent of capacity. No further runoff from snow melt can be expected. Snow cover, short all winter, has for the most part been dissipated by high winds. February through June runoff into the major reservoirs will be approximately 16 percent of normal, totaling about 140,000 acre-feet of water.

The water allotment in the Salt River project has been cut to 1½ acre-feet per acre. This means that irrigators will have to cut their acreage one-third to one-half in order to insure marketable crops. The Gila River project will have one-half acre-foot of water per acre of land at Coolidge Dam. However, considering seepage losses, the delivered amount will be still less. Most of the farmers in the Gila River project are planting only 20 percent of their land and many others are not planting at all. The Gila River will probably be a dead stream by May 15. Pumping costs in both the Gila and Salt River Basins will be

[1] The Division of Irrigation and Water Conservation is the Federal coordinating agency of snow surveys conducted by its staff and many cooperators, including the Bureau of Reclamation, Forest Service, National Park Service, Geological Survey, various departments of the several western States, irrigation districts, power companies, and others. The California State Division of Water Resources conducts and coordinates snow surveys in that State, while the British Columbia Department of Lands and Forests, Water Rights Branch, has charge of the snow surveys in that province.

greater this year due to the most recent 10-foot recession in ground-water level.

The Maricopa Water Conservation District, which distributes the water from Carl Pleasant Dam (capacity 179,000 acre-feet) will receive no surface flow and will have to rely entirely on pumped water. The pump head here now exceeds 300 feet.

The Little Colorado River has experienced practically no runoff all season.

The State, as a whole, will probably enter the winter months of 1951–52 with as little reservoir storage as ever recorded.

CALIFORNIA—California's 1951 summer water supply will be deficient. Snow pack is definitely below normal over the entire length of the Sierras. On the Kern and Kaweah watersheds less snow exists as of April 1 than in the year 1931 and 1934. This is the driest season since comprehensive snow surveys began on those watersheds 22 years ago. Summer flow of Kaweah and Kern Rivers will apparently be less than that of 1924, which was the lowest summer-flow year of record. The greatest deficiencies of summer flow are expected on streams that experienced their highest flood crest of record following the storms of November and December.

The snow pack on the upper Sacramento River gives promise of the best percentage of normal flow for any of the Sierra streams. However, even on this watershed runoff, only 80 percent of normal is expected. Reservoirs are now at favorable stages, and most should fill during the early spring runoff. However, the large multipurpose reservoirs such as Shasta and Millerton probably will not fill. Lake Tahoe is expected to reach 6,228.7 ft. elevation, the highest since 1946.

No significant rain has occurred in California since March 9 and at the time of this report the drought continues. Unless substantial rain occurs during April and May, summer flows forecasted herein will have to be revised downward.

COLORADO—Mountain snow cover is well above normal along the Continental Divide in the northern part of Colorado. In western Colorado the high-elevation snow cover is slightly below normal. In southern Colorado the snow cover is definitely deficient. Runoff during the snow-melt season should be well above average on the South Platte and its tributaries, on the main stream of the Arkansas and on the upper Colorado River. On the Yampa, White, and Gunnison rivers the summer runoff will be about normal. On the Dolores, San Juan, Rio Grande, and the southern tributaries to the Arkansas the summer runoff is not likely to exceed 50 to 60 percent of average. Soil moisture conditions are only fair in irrigated areas especially in the San Juan and Rio Grande basins where the soil is extremely dry.

IDAHO—All the rivers in Idaho, with the exception of Lost River, have snow water stored in the mountains varying from 5 to 30 percent above normal. This general condition assures above-average water supplies for irrigation and power throughout the State. Some snow melt during February has kept stream flow above average. Storage in some reservoirs has been lowered in anticipation of fair to good water supplies yet to come.

The high-altitude snow courses are showing relatively higher snow water content than the courses at lower elevation. This condition may promote more sustained and dependable flow of water throughout the State than usually occurs when low-elevation snow cover is heavy.

MONTANA—Snow pack on the upper Missouri River Basin is somewhat above average and should provide good irrigation water supplies in 1951. The pack this year is not quite as great as in 1950 or 1949, but is greater than in 1948. Thus, potential flood hazard in parts of the basin should not be overlooked. Due to orderly snow melt, controlled stream flow resulted in 1949 and 1950. The 1948 melt season was accompanied by high temperatures and precipitation in such amounts as to cause rapid snow melt, which produced floods on most rivers and tributaries. Consequently, realization of the 1951 flood potential will depend entirely upon meteorological events in the basin during the next 2 or 3 months.

Upper Columbia River Basin in Montana also shows above-normal snow pack this season. Potential flood hazard of modest proportions now exists on some headwater streams of Columbia River in Montana. The magnitude of this potential depends entirely on melting conditions during the snow-melt season. In any event, very good water supplies for the basin are foreseen.

NEVADA—The drought of the Southwest is continuing its move northward into Nevada and at this time it encompasses the southern two-thirds of the State and the eastern slope of the Sierra Nevada. The only bright spot is the Humboldt River which is expected to flow 150 percent of normal. The floods of last November and December were a blessing in disguise, for they filled reservoirs and mountain and valley soils. Runoff of snow-stored water will be less than 50 percent of normal from the Sierra while the central and southern part of the State will realize only from 10 to 25 percent of normal. Storage in Lake Mead equals 95 percent of last year but less than 90 percent or normal for this date.

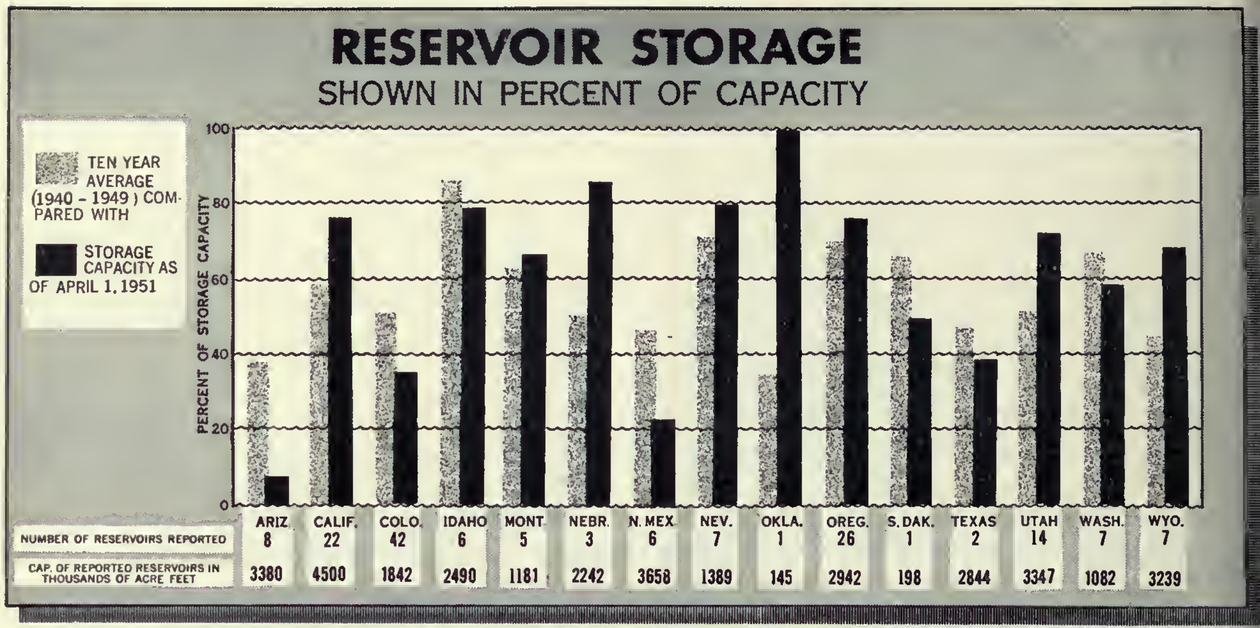
NEW MEXICO—A critical shortage of irrigation water is foreseen this season for lands along the Rio Grande. Snow cover in northern New Mexico is very deficient with many snow courses showing the least since surveys were started in 1937. The summer flow of the Rio Grande through New Mexico will not exceed 25 percent of the irrigation water demand. El Vado Reservoir, supplying the middle Rio Grande area, is practically empty. Storage in Elephant Butte Reservoir and Caballo Reservoir is about 400,000 acre-feet. This amount will supply about one-half of the normal irrigation-water demand in the lower Rio Grande valley. Considerable amount of crop curtailment will be necessary. Soil moisture conditions in all irrigated areas are reported as dry.

OREGON—Water supply for 1951 will be generally good to excellent. Reservoir storage for the entire State, with few exceptions, will be adequate. Many reservoirs will hold substantial reserves at the conclusion of the 1951 season. Owyhee Reservoir now holds 2 years' supply and is full for the first time since 1946. The only appreciable snow shortage on watersheds is in extreme southern and southwestern Oregon. Runoff is expected to be above normal throughout the State except for Applegate and Illinois rivers in southern Oregon and in the Grande Ronde, Umatilla River, and northern Harney valleys. However, flows in the latter three areas should be nearly average.

SOUTH DAKOTA—Snow cover in the Black Hills has been deficient all winter. The water supply outlook is not much better than fair. Soil moisture conditions in the irrigated areas are reported as dry. Belle Fourche Reservoir now stores 94,000 acre-feet as compared to 93,000 acre-feet a year ago and 127,000 acre-feet for the 10-year average (1940–49). Angostura Reservoir, newly operating, with a total capacity of 160,000 acre-feet, has now filled to 32,000 acre-feet.

UTAH—Extreme variation is shown in the water supply prospects for Utah during 1951. Severe drought faces all water users in the southern half of the State, with water supplies varying from 25 to 45 percent of the preceding 10-year average. In northeastern Utah on Ashley Creek, the Whiterocks, and Uinta rivers, streamflow will be 65 to 70 percent of average. Northwesterly from these areas, water supply outlook increases to as much as 40 percent above average as indicated by the snow blanket on the Cache and northern Wasatch forests. In these watersheds above-normal temperatures during the melt period could produce damaging peak flows. Reservoir storage supplies are excellent in northern Utah. In southern Utah, low reservoir storage will increase the severity of the water shortage.

WASHINGTON—Prospects for water supplies in Washington are fair to good. Water stored in snow ranges from 5 to 50 percent above normal. Snow cover



Most State averages for reported reservoirs are for full 10-year period, but in a few cases reservoirs having shorter records are included. CALIFORNIA—does not include Millerton or Shasta reservoirs (combined capacity 5,020,500 acre feet) April 1 combined storage 4,011,000 acre feet. COLORADO—does not include John Martin reservoir (capacity 685,000 acre feet) April 1 storage 80,800 acre feet. MONTANA—does not include Fort Peck reservoir (capacity 19 million acre feet) April 1 storage 12,960,000 acre feet, also does not include Flathead Lake (capacity 1,791,000 acre feet) April 1 storage 651,600 acre feet. NEVADA—does not include Lake Mead (capacity 27,217,000 acre feet) April 1 storage 16,806,000 acre feet. OKLAHOMA—new reservoir 1945. WASHINGTON—does not include Roosevelt Lake (capacity 5,220,000 acre feet) April 1 storage 4,749,000 acre feet.

on the Methow River drainage is 50 percent above average. This implies a serious threat of high water if a cold spring should now occur and delay snow melt until late in the season.

Water stored as snow in British Columbia (nearly one-half of the flow of the main stem of the Columbia River comes from British Columbia) is slightly greater than at this time in 1950, being 30 percent above normal. However, water stored in snow on other rivers contributing to the Columbia, is generally less than in 1950. Even so, a cold late spring coupled with heavy precipitation would cause serious high water on the Columbia again.

Wyoming—The irrigation water supply outlook for both the Green and North Platte River watersheds in Wyoming is excellent. On the Green River the snow cover is 150 percent of normal. Soil moisture conditions are reported as excellent. The summer discharge of the Green River will probably not be as high as a year ago because of the heavy snowfall during April 1950.

On the North Platte drainage the snow cover is about 110 percent normal and on the Laramie drainage about 130 percent. The irrigation water supply for lands below the major reservoirs on the North Platte is assured. Storage in these reservoirs is now about 1,700,000 acre-feet. This is a record high storage and represents two times the past 10-year average. Soil moisture conditions in the upper Laramie valley and in the Wheatland area on the same stream are relatively poor. Similar soil moisture conditions exist along the North Platte in eastern Wyoming and western Nebraska.

Snow covering the high watershed of the Snake River in western Wyoming varies from 24 to 27 percent above normal as of April 1. This insures the Jackson Hole area and adjacent lands below in Idaho of a good water supply for the 1951 season. Very good water supplies are foreseen for northern Wyoming, including Yellowstone, Wind, Big Horn, Tongue, and Powder river basins.

British Columbia—Water supply prospects for southern British Columbia are very good and far better than average. The Okanogan and Kootenai areas can expect unusually high runoff. Orderly snow melt has already started, but since snow cover is far above average, any interruption of the spring thaw by unseasonably cold weather would almost surely result later in extremely high flows. The flood potential must therefore be recognized although it cannot be so clearly defined now as a month hence. If the present thawing weather continues through April, the flood potential will be materially lessened by May first. However, in any event, quite high flows are in prospect for Kootenai and Okanogan rivers due to the tremendous snow pack on those watersheds.

The End.

Here are a few items not covered by Mr. Work's report. Deerfield reservoir, on the Rapid Valley project in South Dakota, with a capacity of about 15, 000 acre-feet, may spill this year, an item of special significance as the Bomber Base at Rapid City depends upon Rapid Creek's water supply. North Dakota's Dickinson and Heart Butte reservoirs are both full (storing 7,000+ acre-feet, and 200,000 acre-feet, respectively).

Water Stored in Reclamation Reservoirs

Location	Project	Reservoir	Storage (in acre-feet) Active capacity [1]	Mar. 31, 1950	Mar. 31, 1951
Region 1	Baker	Thief Valley	17, 400	11, 000	18, 100
	Bitterroot	Lake Como	34, 700	20, 000	20, 000
	Boise	Anderson Ranch	464, 200	133, 000	329, 800
		Arrowrock	286, 600	172, 100	167, 700
		Deadwood	161, 900	107, 300	109, 100
		Lake Lowell	169, 000	152, 400	157, 600
	Burnt River	Unity	24, 600	6, 500	15, 000
	Columbia Basin	F. D. Roosevelt	5, 220, 000	4, 555, 000	4, 749, 000
	Deschutes	Crane Prairie	50, 000	47, 000	53, 000
		Wickiup	182, 000	185, 300	188, 000
	Minidoka	American Falls	1, 700, 000	1, 527, 800	1, 389, 200
		Jackson Lake	847, 000	449, 600	459, 600
		Lake Walcott	95, 200	87, 000	89, 200
		Grassy Lake	15, 200	13, 200	13, 200
		Island Park	127, 300	127, 800	115, 000
	Okanogan	Conconully	13, 000	7, 500	7, 600
		Salmon Lake	10, 500	6, 600	10, 000
	Owyhee	Owyhee	715, 000	526, 500	715, 000
	Umatilla	Cold Springs	50, 000	45, 400	50, 000
		McKay	73, 800	66, 400	64, 300
	Vale	Agency Valley	60, 000	33, 200	32, 900
		Warm Springs	191, 000	48, 200	82, 600
	Yakima	Bumping Lake	33, 800	11, 700	5, 200
		Cle Elum	435, 700	267, 700	256, 700
		Kachess	239, 000	187, 600	174, 700
Region 2		Keechelus	153, 000	71, 500	65, 900
		Tieton	197, 000	110, 200	106, 200
	Central Valley	Millerton Lake	500, 000	184, 500	339, 400
		Shasta	4, 366, 800	3, 339, 800	3, 525, 200
	Klamath	Clear Lake	513, 300	149, 300	139, 300
		Gerber	94, 300	41, 400	57, 600
		Upper Klamath Lake	524, 800	414, 100	441, 300
Region 3	Orland	East Park	50, 600	49, 200	49, 300
		Stony Gorge	50, 000	42, 500	51, 000
	Boulder Canyon	Lake Mead	27, 207, 000	17, 686, 000	16, 806, 000
	Parker	Havasu	688, 000	663, 400	605, 700
	Salt River	Bartlett	179, 500	59, 700	6, 000
		Horse Mesa	245, 100	227, 100	136, 000
		Horseshoe	144, 000	2, 300	1, 000
		Mormon Flat	57, 900	51, 200	54, 000
Region 4		Roosevelt	1, 381, 600	276, 100	5, 000
		Stewart Mountain	69, 800	48, 800	48, 000
	Fruit Growers	Fruit Growers	4, 500	4, 200	3, 000
	Humbolt	Rye Patch	179, 000	55, 400	109, 100
	Hyrum	Hyrum	15, 300	10, 600	10, 300
	Moon Lake	Moon Lake	35, 800	20, 800	20, 500
	Newlands	Lahontan	290, 900	185, 700	234, 600
		Lake Tahoe	732, 000	228, 000	592, 800
	Newton	Newton	5, 300	4, 900	5, 100
	Ogden River	Pine View	44, 200	5, 800	10, 200
	Pine River	Vallecito	126, 300	55, 100	27, 100
	Provo River	Deer Creek	149, 700	117, 800	124, 100
	Scofield	Scofield	65, 800	25, 200	32, 200
	Strawberry Valley	Strawberry	270, 000	119, 500	141, 500
	Truckee River Storage	Boca	40, 900	16, 100	19, 400
Region 5	Uncompahgre	Taylor Park	106, 200	72, 600	51, 100
	Weber River	Echo	73, 900	43, 900	48, 200
	W. C. Austin	Altus	145, 000	119, 900	145, 000
	Balmorhea	Lower Parks	6, 000	6, 500	6, 600
	Carlsbad	Alamogordo	131, 900	102, 000	81, 800
		Avalon	6, 600	3, 200	1, 100
	Rio Grande	Caballo	345, 900	220, 800	154, 200
Region 6		Elephant Butte	2, 197, 600	655, 900	255, 200
	Tucumcari	Conchas	269, 100	209, 600	182, 500
	Belle Fourche	Belle Fourche	185, 200	93, 000	94, 300
	Milk River	Fresno	127, 200	17, 700	99, 900
		Nelson	68, 800	5, 700	16, 700
		Sherburne Lakes	66, 100	39, 000	30, 500
	Riverton	Bull Lake	155, 000	6, 200	79, 500
		Pilot Butte	31, 500	13, 600	13, 800
	Shoshone	Buffalo Bill	394, 600	169, 400	269, 100
	Sun River	Gibson	105, 000	46, 600	80, 600
Region 7		Pishkun	30, 100	18, 800	18, 900
		Willow Creek	32, 400	3, 800	26, 000
	Colorado-Big Thompson	Green Mountain	146, 900	68, 400	54, 800
	Kendrick	Alcova	190, 300	154, 300	169, 500
		Seminoe	993, 200	518, 800	491, 700
	Mirage Flats	Box Butte	30, 600	26, 400	23, 500
	North Platte	Guernsey	44, 200	25, 100	39, 700
		Lake Alice	11, 000	3, 500	------------
		Lake Minatare	60, 800	24, 200	25, 400
		Pathfinder	1, 040, 500	915, 000	963, 300

[1] Available for irrigation.

LETTERS

An Acknowledgment From Africa

University of the Witwatersrand
Milner Park, Johannesburg
South Africa

I was pleased to receive, through the American Consul General, your letter 220 of November 29, 1950, which reached me only a short time ago on my return to Johannesburg. The recording of the "Voice of America" broadcast of October 3, 1950, and the copies of the Reclamation Era have arrived and add to the pleasure felt by me on reading your kind letter of November 29. I feel it is a great privilege to have once more had the opportunity of studying the methods and work of the Bureau of Reclamation and I greatly value the benefits I have derived from my discussions and contacts with you and members of your staff. My memories of my period of training in 1921–22 and my recent studies of the work of the Bureau of Reclamation are vivid and enduring and the experience gained on each of these occasions brings to me an obligation to assist and affords a means of assisting in the development of the Union of South Africa. In concluding this brief letter of acknowledgement and thanks, I wish to express my appreciation of the privilege of once more having enjoyed the hospitality of so many of the American people and of observing their spirit and resolution in the present troublesome times.

Yours sincerely,

W. G. Sutton.

Era Subscriber for 33 Years

Buenos Aires, Argentina.

Dear Editor: In the Reclamation Era of January 1951, page 23, you give notice of an Era subscriber for 34 years, and that you will be interested in hearing from other long time subscribers.

I am somewhat younger. I am an Era subscriber for 33 years starting in January 1918, but from outside of the United States, from Argentina. This may be a record.

Why have I kept my subscription? During my career, as assistant hydraulic engineer, chief engineer, chief of the Irrigation Dept. of Argentina, University professor and actually consulting engineer, I have always found in the Era, useful information for my successive jobs. That is all.

Yours sincerely;

Rodolfo E. Ballester.

We are glad to hear from our neighbors in South America, and especially a long-term subscriber of such good standing. Let us hear from more of our friends.—Ed.

Deep Is the Heart of Texas

From R. F. Travis, who has a farm at Ysleta, Tex., comes this note (along with his check for a two-year renewal): "Thanks for the important information contained in the Era—we greatly appreciate it." ●

Kansas Comments

Webster, Kans.
March 1st, 1951

We wish to thank you, whole heartedly, for the marked copy of the Reclamation Era, also for the compliments extended by the Bureau of Reclamation which we received in our mail today . . . we only hope to see and enjoy in the not far off future, the benefits of our Kansas projects that are being considered here in this central part of Kansas, where, water heretofore, at times, has really spelled, "Existence."

Very truly yours,

Mr. and Mrs. Curtis Fry.

More Drinking Water

412 Kiesel Building,
Ogden, Utah.

We were considerably interested in the article appearing in the January Era regarding the construction of a Drinking Water system for the Lewiston Orchards project.

It may not be generally known but for 8 years water of the Ogden River project has been utilized for drinking purposes for the government housing project just south of Ogden and known as "Washington Terrace." This project has a population of 6,000 and is a part of the South Ogden Conservation District, one of our subscribing units.

The water is purified by a plant constructed by the housing project and is operated only in the summer time. F[illegible] the balance of the year the Terrace [illegible] supplied with water by the City [illegible] South Ogden.

Very truly yours,

Arlie S. Campbell,
Assistant Secretary.

We are most grateful to the Ogde[n] River Water Users Association for th[is] communication, and hope they will co[r]respond with their magazine more fr[e]quently. The Ogden River Water User[s] have a right to feel proud of the[ir] project. In addition to supplying drin[k]ing water, this project also provides [a] supplemental water supply to the ir[ri]gation farms. Let us hear from mor[e] of our projects. We greatly appre[ci]ate your interest.—Ed.

RELEASES

Special Issue of La Houille Blanch[e] on the Genissiat Dam

Assistant Director, F. Revol, [of] Grenoble, France, has sent us a com[]munication regarding a special issu[e] of La Houille Blanche, Revue D[e] L'Ingeniur Hydrualicien, which is de[]voted entirely to discussions of th[e] Genissiat dam and power plant, de[]scribed as a masterpiece of the Frenc[h] technique. The announcement o[f] *priere d'inserer* which accompanie[s] this letter states that La Houill[e] Blanche published this specially ded[i]cated issue in cooperation with the Na[]tional Company of the Rhone. Th[e] volume contains 296 pages, 225 illustra[]tions, and constitutes a complete mono[]graph on the project planning, civil en[]gineering, equipment, hydro-electri[c] problems and the present operation and future development of the Genis[]siat project, compiled by such eminen[t] engineers as M. Henry, M. Gignoux, M[.] Mathian, M. G. Gres, M. Ch. Chagnaud[,] M. H. Escalon, M. H. Diserens, M. A[.] Robert, M. G. Ferrand, M. L. Armanet[,] M. H. Gerodolle, M. F. Mussard an[d] M. P. Delattre. The publication i[s] written in French and can be ordered from La Houille, Blanche, Postal Bo[x] 41, Grenoble, Isere, France. Pape[r] backed copies are 1,400 francs, bound copies, 2,100 francs. ●

More Wells Used in Utah

phenomenal increase in irrigation ells in Escalante Valley in southern Utah, which has resulted in ping a part of the valley beyond ate of replenishment has been re-d in a Geological Survey report re-d in March 1951 by the Depart- of the Interior.

ice World War II more than 170 irrigation wells have been drilled e valley, and pumpage from wells ased from 24,000 acre-feet in 1945 ore than 80,000 in 1950. The great- ncrease in irrigated acreage has in the southern part of the valley the town of Enterprise where t 52,000 acre-feet of water was ped in 1950.

1950 the pumpage from wells in Beryl-Enterprise area was far er than the natural replenishment e ground-water reservoir, and wa- evels in some irrigation wells were lowered more than 2 feet a year. e ground-water reservoir still holds st amount of water in accumulated age, and present rates of pumping l be continued for several decades re the ground-water reservoir would mptied. However, the water must umped from progressively greater hs and therefore at increasing cost the years.

though pumpage in excess of re-ishment is a new development in lante Valley, wells have been used for irrigation for more than 30. The recharge was evidently ade-e to sustain the draft prior to 1945, pt in the 1931–35 drought. In addi- considerable ground water has been harged each year by evaporation transpiration in the lower parts of valley, where the water table is at low depth. This natural waste of er is still continuing at a rate of ral thousand acre-feet a year.

ese are some of the findings in an stigation of the ground-water re-ces of Escalante Valley, undertaken he Geological Survey in cooperation the Utah State Engineer. A prog- report of this investigation, en-d "Ground water in Escalante ey, Beaver, Iron, and Washington nties, Utah," has just been pub-ed as part of the State Engineer's ty-seventh biennial report. Copies be obtained by writing to the State ineer, 401 State Capitol Building, Lake City, Utah. ●

Ground Water in Baker Valley, Oreg.

Ground water in ample supply for much additional irrigation development is available at shallow depth in Baker Valley, Baker County, Oreg.

This information is given in a Geological Survey report, released in March by the Department of the Interior, describing the water-bearing strata in Baker Valley, the chemical character of the ground water, the annual fluctuation of the water levels, and the types and yields of the wells.

The report gives the findings of an investigation of ground-water resources made during 1946–49 by the Geological Survey in cooperation with the Bureau of Reclamation and the Oregon State Engineer. It places special emphasis upon the quality of the water in relation to its usefulness for various purposes, and presents 108 complete analyses of ground and surface waters made by the Bureau of Reclamation.

Copies of the report, entitled "Ground-water resources of Baker Valley, Baker County, Oreg.," by Frederick D. Trauger, may be consulted at the offices of the Geological Survey at Room 2209, General Services Building, Washington, D. C., and Room 623, Post Office Building, Portland, Oreg.; at the office of the Oregon State Engineer, Salem, Oreg.; at the district office of the Bureau of Reclamation, Walla Walla, Wash.; and at the public library in Baker, Oreg. ●

POSTSCRIPTS

Shasta and Keswick Reach New High in Production

Record power production at Shasta and Keswick power plants during the month of December swelled the Central Valley Project's return to the U. S. Treasury by more than one million dollars. The two plants produced a total of 303,609,000 kilowatt-hours of electric energy, or three times the amount required by the city of San Francisco during an average 30-day period.

Income Tops Outgo

Rough estimates of seven Bureau of Reclamation project areas show that residents of farms and adjacent towns, whose livelihood is directly dependent on Federal reclamation projects, paid personal income taxes of $57 million in 1949. Their cumulative income tax payments since 1916 total $384 million. The cost of developing these seven projects was $163 million—two and one-third times less than the income tax from the area.

Power Sale Hits New High

Income from sale of power in the 1950 fiscal year hit an all-time high of $33,200,000. A total of 19,790,000,-000 kilowatt-hours of hydroelectric power was sold. Despite this record, the demand for power soars far ahead of the Bureau's ability to meet the need. ●

CORRECTION

Wade M. Taylor, recently appointed Regional Power Manager for the Bureau of Reclamation's Region 3, received his Bachelor of Science and Master of Science degrees in Electrical Engineering at the University of Colorado, not at Purdue, as stated in error on page 60 of the March 1951 issue. Mr. Taylor took his freshman year at Purdue University and then transferred to the University of Colorado where he received his B. S. in 1934 and his M. S. in 1935. The University of Colorado is justifiably proud of Wade M. Taylor and Mrs. Taylor, both of whom received their engineering degrees from that University. ●

Getting the Credits Straight

On page 71 of the April 1951 issue of the Reclamation Era, the photos illustrating the article nominating W. G. Sloan—Co-Author of the Missouri River Basin Plan—were all incorrectly credited to Norton T. Novitt, Region 7 photographer, who should have been credited only for the photo of Sloan, Senator Butler and Commissioner Straus at the Trenton Dam dedication. The photo of W. G. Sloan and Major General Lewis A. Pick was taken by T. R. Broderick, photographer for Region 6; and the photo of Assistant Secretary of Interior William E. Warne reading a citation as Governor Val Peterson of Nebraska pinned a Gold Medal on Sloan was taken by District Photographer Friend Slote of the Bureau's Grand Island, Nebr., office. ●

NOTES FOR CONTRACTORS

Contract Awarded During March 1951

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contr amou
DS-3252	Rio Grande, N. Mex-Tex	March 8	1 7,500-kilovolt-ampere transformer with three 34,500-volt lightning arresters, 1 46,000-volt disconnecting fuse, and 2 current and 2 potential transformers for Willard substation, schedules 1, 6, and 8.	Westinghouse Electric Corp., Denver, Colo.	$87
DS-3252	do	do	2 34,500-volt circuit breakers for Willard substation, schedule 3	Pacific Electric Mfg. Corp., San Francisco, Calif.	16
DS-3257	Columbia Basin, Wash	March 12	2 43,000-kilovolt-ampere transformers for Grand Coulee power plant.	Westinghouse Electric Corp., Denver, Colo.	264
DC-3272	Colorado-Big Thompson, Colo.	March 1	Construction of system dispatchers' building at Flatiron, schedule 1.	Ring Construction Co., Colorado Springs, Colo.	248
DS-3273	Central Valley, Calif	March 8	10 vertical-shaft pumping units for pumping plants on laterals 124.5E, 127.7E, 130.4E, unit 3, Southern San Joaquin municipal utility district, Friant-Kern canal distribution system, schedule 2.	Berkeley Pump Co., Berkeley, Calif.	17
DC-3278	Missouri River Basin, Nebr.-Kansas.	March 5	Construction of earthwork and structures for Superior lateral system, sublaterals drains, and channel changes.	Tom Hellander Co., Fargo, N. Dak.	234
DC-3279	Colorado-Big Thompson, Colo.	March 20	Furnishing and installing one 35,000-kilovolt-ampere vertical-shaft generator (second unit) for Flatiron power plant.	Westinghouse Electric Corp., Denver, Colo.	348
DC-3282	Hungry Horse, Mont	March 13	Completion of Hungry Horse Dam, power plant, and switchyard.	Grafe-Shirley-Lane Co., Los Angeles, Calif.	1,792
DC-3283	Central Valley, Calif	March 14	Constructing foundations, erecting steel towers, and stringing conductor and overhead ground wires for the replacement of wood-pole sections with steel tower lines on 230-kilovolt Shasta-Tracy Nos. 1 and 2 transmission lines.	Erickson, Phillips & Weisberg, Oakland, Calif.	90
DC-3284	Boulder Canyon, Ariz.-Calif.-Nev.	March 19	Construction of earthwork, pipelines, and structures for lateral 94.2 and sublaterals, part 1 of unit 9, Coachella Valley distribution system, All-American Canal System.	R. V. Lloyd and Co., Coachella, Calif.	342
DS-3286	Fort Peck, Mont	March 13	4 carrier-current telephone transmitter-receiver sets, 6 carrier line tuning units 2 115,000-volt and 2 161,000-volt coupling capacitors, and 6 carrier-current line traps for Fort Peck power plant, and Havre, Shelby, and Great Falls substations, schedules 1, 2, and 3.	General Electric Co., Denver, Colo.	20
DC-3288	Missouri River Basin, Colo	March 8	Construction of an earth embankment test section at Bonny Dam.	Northwestern Engineering Co., Denver, Colo.	8
DC-3289	Kendrick, Wyo	March 27	Installing overhead ground wires on 141 miles of Seminole-Cheyenne 115-kilovolt transmission line.	Trans-Electric Co., Louisville, Ky.	111
DS-3290	Colorado-Big Thompson, Colo.	March 6	4 3-foot by 6-foot 6-inch high-pressure gates with 4 85,000-pound hydraulic hoists and 4 conduit linings for outlet works at Willow Creek Dam.	Northwest Marine Iron Works, Portland, Oreg.	49
DS-3298	Central Valley, Calif	do	5 traveling water screens for laterals 124.5E, 127.7E, and 130.4E, Southern San Joaquin municipal utility district, unit 3, Friant-Kern canal distribution system.	Link-Belt Co., San Francisco, Calif.	42
DS-3299	Rio Grande, N. Mex	March 22	1 115,000-volt circuit breaker for Elephant Butte switchyard, schedule 1.	Pacific Electric Mfg. Corp., San Francisco, Calif.	27
DS-3301	Colorado-Big Thompson, Colo.	do	One 100-ton gantry crane with 20-ton auxiliary hoist for Flatiron power and pumping plant.	Pacific Coast Engineering Co., Alameda, Calif.	129
DC-3302	do	March 19	Construction of 36 miles of Flatiron-Fort Collins-Cheyenne tap 115-kilovolt transmission line.	Trans-Electric Co., Louisville, Ky.	389
DC-3303	Gila, Ariz	March 29	Furnishing and installing 2 12-foot by 15-foot 3-inch, two 10-foot by 5-foot, 1 10-foot 8-inch by 6-foot 6-inch, and 1 12-foot 8-inch by 6-foot 6-inch radial gates; and 2 10,000-pound and 4 float-operated radial-gate hoists for Wellton-Mohawk canal.	Western Contracting Corp., Los Banos, Calif.	59
DC-3308	Rio Grande, N. Mex	March 8	Construction of 13,000/16,250-kilovolt-ampere Albuquerque substation.	Reynolds Electrical & Engineering Co., Inc., El Paso, Tex.	62
DC-3309	Central Valley, Calif	March 20	Furnishing and installing the heating, ventilating, and air-conditioning system for lower vista house at Shasta Dam.	Western Heating & Air Conditioning, Glendale, Calif.	14
DC-3314	Colorado-Big Thompson, Colo.	March 27	Construction of 59 miles of Salida-Gunnison 115-kilovolt transmission line.	Trans-Electric Co., Louisville, Ky.	82
DS-3317	Cachuma, Calif	March 19	Chlorination equipment for Tecolote tunnel and Lauro chlorination and control houses South Coast conduit, Goleta section.	Wallace & Tiernan Sales Corp., Belleville, N. J.	40
DS-3324	Colorado-Big Thompson, Colo.	March 29	2 vertical-shaft centrifugal pumps for Willow Creek pumping plant.	Worthington Pump & Machinery Corp., Harrison, N. J.	154
100C-116	Palisades, Idaho	March 23	Furnishing and erecting 140,000-gallon water tank for Palisades camp, schedule 2.	Chicago Bridge & Iron Co., Salt Lake City, Utah.	2
200C-148	Central Valley, Calif	March 6	Installing and painting miscellaneous metalwork at Shasta Dam, schedule 1.	Wiscombe Painting & Decorating Co., Salt Lake City, Utah.	31
200C-148	do	March 7	Installing and painting miscellaneous metalwork at Shasta Dam, schedule 2.	R. A. Neuman & Sons, McMinnville, Oreg.	18
300C-15	Davis Dam, Ariz.-Nev	March 8	Construction of warehouse and fencing for Prescott substation.	Jost Construction Co., Prescott, Ariz.	20
300C-19	do	March 1	Construction of 12.5-kilovolt structure for Coolidge substation	Newberry Electric Corp. of Arizona, Phoenix, Ariz.	[illegible]
300C-13	Boulder Canyon, Ariz.-Calif.-Nev.	March 2	Constructing shop building at Boulder City, Nev	Lembke Construction Co., Las Vegas, Nev.	68
600C-54	Missouri River Basin, Mont.	March 15	Construction of warehouse and fence for Canyon Ferry Dam and power plant.	Otis Williams & Co., Helena, Mont.	20
703C-171	Missouri River Basin, Wyo	March 26	Erecting prefabricated garage and machine shop at Reclamation Center near Casper, Wyo.	Long Construction Co., Inc., Billings, Mont.	39
703C-175	North Platte, Wyo	March 21	Rehabilitation of existing laterals, Fort Laramie Canal	Harry F. Berggren & Sons, Inc., Scottsbluff, Nebr.	78
704S-168	Colorado-Big Thompson, Colo.	March 20	Station service switchgear, transformer and voltage-regulator assembly for system dispatchers' building at Flatiron.	Westinghouse Electric Corp. Denver, Colo.	18

Construction and Materials for Which Bids Will Be Requested by July 1951

Project	Description of work or material
ma, Calif.	Construction of 6,000-foot long, 6-foot diameter, concrete-lined, horseshoe-shaped Sheffield tunnel near Santa Barbara, Calif.
l Valley, Calif.	Construction of 25 miles of concrete and reinforced concrete irrigation pipe lines, 12 to 36 inches in diameter, for the Stone-Corral irrigation district, Friant-Kern canal distribution system, near Seville, Calif.
o	Construction of 20 miles of concrete and reinforced concrete pipe lines for Unit 1, Exeter irrigation district, Friant-Kern canal distribution system, near Exeter, Calif.
do-Big Thomp- Colo.	Construction of 11 miles of partially concrete-lined St. Vrain supply canal, 550 cubic-feet-per-second capacity, including a 1,200-foot long concrete siphon and culverts, about 8 miles west of Berthoud, Colo.
o	Construction of Flatiron section of Horsetooth feeder canal, including 3.5 miles of 930 cubic-feet-per-second capacity concrete-lined canal, a 700-foot tunnel, and 2 siphons about 500 feet in length, 10 miles west of Loveland, Colo.
o	Installation of a 5,000-kilovolt-ampere transformer bank in Fort Morgan substation.
o	Construction of sidewalks and curbs, drainage facilities, exterior lighting, and road and parking area surfacing at Granby pumping plant near Granby, Colo.
o	Painting plaster walls and ceilings at Granby pumping plant.
o	Alternating-current distribution board, direct-current distribution board, battery charging equipment, motor and heating control boards, lighting transformers, and station service transformers for Flatiron power and pumping plant.
o	Generator voltage switchgear, 15-kilovolt, for Flatiron power and pumping plant.
o	Dispatcher's system map board for Flatiron dispatcher office.
o	Motor and generator neutral grounding equipment for Pole Hill and Flatiron power plants.
bia Basin, Wash.	Construction of 15.5 miles of unlined Potholes East canal, 1,800 cubic-foot-per-second capacity, and 5 miles of unlined Ringold wasteway, 1,800 cubic-foot-per-second capacity, about 6 miles southeast of Othello, Wash.
o	Landscaping right switchyard and left abutment at Grand Coulee dam.
na, Alaska	Construction of 4.4-mile, 9-foot diameter, concrete-lined Eklutna tunnel and surge tank.
Fort Peck, Mont.	Furnishing and erecting 200-foot tower and erecting 4 Government-furnished towers, each 140 feet high, and furnishing and erecting 3 8- by 8-foot prefabricated control buildings.
Hungry Horse, Mont.	2 carbon-dioxide fire extinguishing systems for Hungry Horse power plant.
Klamath, Oreg.-Calif.	Construction of pumping plants "R" and "S" in N Canal area, second extension, Tule Lake division.
Kendrick, Wyo.	Construction of 36 miles of Seminoe Dam-Bairoil 34.5-kilovolt transmission line.
Do.	Construction of 30 miles of Sinclair-Hanna 34.5-kilovolt transmission line.
Do.	Construction of 35 miles of double-circuit telephone line from new Casper substation to Alcova Dam.
Missouri River Basin, Colo.	Construction of 3,000-kilovolt-ampere Julesburg substation.
Missouri River Basin, Mont.	Construction of Canyon Ferry-East Helena 115-kilovolt transmission line consisting of 2 parallel lines each 8 miles long.
Missouri River Basin, Nebr.	Construction of Ogallala substation, including constructing foundations, erecting structural steel, and installing electrical equipment. The substation has one 7,500-kilovolt-ampere transformer, 1 115-kilovolt bay, and 3 34.5-kilovolt bays.
Do.	Construction of Chadron substation, including foundations, erecting structural steel, and installing all electrical equipment. The substation has 3 3,333-kilovolt-ampere transformers, 1 115-kilovolt bay, and 2 34.5-kilovolt bays.
Missouri River Basin, S. Dak.	Construction of 135 miles of 230-kilovolt steel tower transmission line between Oahe damsite and Fort Randall power plant.
Missouri River Basin, Wyo.	Construction of 15,000-kilovolt-ampere Lovell substation.
Do.	Construction of 2,000 feet of Alcova switchyard road about 32 miles southwest of Casper, Wyo.
Do.	Furnishing and erecting 16 miles of four-wire telephone line from Moorcroft, Wyo., to site of Keyhole Dam.
Do.	Main control board, distribution boards, and battery charger for Lovell substation.
Shoshone, Wyo.	Construction of Willwood canal crossing of the C.J. Coulee near Cody, Wyo., by the use of a bench flume on an earth dike or by use of a monolithic concrete siphon.
Yakima, Wash.	Rehabilitation of Bumping Lake Dam outlet structure and tower near Yakima, Wash.
Do.	Rehabilitation of Kachess Dam outlet works channel near Easton, Wash.

United States Department of the Interior
Oscar L. Chapman, Secretary
BUREAU OF RECLAMATION OFFICES

Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

Commissioner's Staff

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Assistant Commissioner	Wesley R. Nelson
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Assistant to the Commissioner—Engineering	T. W. Mermel
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REGIONAL OFFICES

REGION 1: Harold T. Nelson, Regional Director, Box 937, Reclamation Building, Fairgrounds, Boise, Idaho.
REGION 2: R. L. Boke, Regional Director, Box, 2511 Old Post Office Building, Sacramento 10, Calif.
REGION 3: E. A. Moritz, Regional Director, Administration Building, Boulder City, Nev.
REGION 4: E. O. Larson, Regional Director, 32 Exchange Place, P. O. Box 360, Salt Lake City 8, Utah.
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SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1 a year for persons residing in the United States and Canada; $1.50 a year for foreign subscriptions; special rate of 50 cents a year for members of water users' associations, and Bureau of Reclamation employees.

OUR FRONT COVER

Being an orphan is not so bad if you have "Bummer's" luck. Found out in the cold on the Watenpaugh farm he wound up adopted in the capable hands of Miss Mary Jean Watenpaugh of Meridian, Idaho, who happens to be the sister of Lee Watenpaugh, whose prize-winning essay appears on page 122 of this issue. *Photo by Phil Merritt, Region 1 photographer.*

30 YEARS AGO IN THE ERA

EMANCIPATION

(Inspired by the Newlands National Irrigation A
June 17, 1902)

The Nation reaches its hand into the Desert,

And lo! private monopoly in water and in land is scou
from that holiest of temples—the place where men l
and build their homes!

The Nation reaches its hand into the Desert.

The wasting floods stand back, the streams obey t
master, and the stricken forests spring to life again
upon the forsaken mountains!

The Nation reaches its hand into the Desert.

The barred doors of the sleeping empire are flung
open to the eager and the willing, that they may
enter in and claim their heritage!

The Nation reaches its hand into the Desert.

That which lay beyond the grasp of the individual yi
to the hand of Associated Man. Great is the
Achievement—greater the Prophecy!

From "Conquest of Arid America," 1905 Edition
Wm. E. Smythe.

(Reprinted from the June 1921 issue of the RECLAMA
RECORD, predecessor to the RECLAMATION ERA.)

RECLAMATION PLACE NAMES IN THIS ISSUE

new twist on sediment

**by E. J. CARLSON,
Engineer,
Branch of Design and
Construction,
Denver, Colo.**

NTERNATIONAL PARTNERSHIP made possible the construction of hese curved divide walls at the Superior-Courtland Dam and anals. Far-off India helped solve the problem of diverting and eeping the canal clean. ***Photo by R. Boyce, Region 7.***

FROM THE BUREAU'S RESEARCH LABORATORIES in Denver comes the good news of the latest successful effort to curb one of the water users' stealthiest enemies—sediment.

The new development is based on the laboratory-tested technique called curve principle of diversion. It has been adapted in the design of the headworks for the Superior and Courtland Canals which start at the Superior-Courtland Diversion Dam. The dam is a brand new feature of the Missouri River Basin project on the Republican River near Guide Rock, Nebr.

Here is the background on the research development of the curve principle and its application—the new twist on sediment.

When the preliminary designs for the Superior-Courtland Diversion Dam were being studied, engineering brows were furrowed in concern over the large concentration of sediment that will be carried by the Republican River to the dam. This load of river-bed material could then be drawn into the headworks of the Superior and Courtland Canals which flank the upstream side of the diversion structure. From available data on the river's sediment concentration, the engineers learned that the bed load averaged about two-tenths of 1 percent of the water discharge during the years from 1943 to 1946. Applying this percentage to the water requirements for irrigated lands to be served under these canals, they then deduced that should this same sediment-laden water enter the headworks without hindrance, the bed-load material deposited would amount to about 170,000 cubic yards each year.

Definitely a headache for the Bureau's sedimentation specialists and a whopping potential backache for the shovel-wielding irrigation farmer!

The engineers of the Denver hydraulic laboratory were then consulted and asked to assist in recommending a design which would reduce the amount of coarse sediment transported through the headworks of the canals.

The hydraulic research engineers reasoned that the best plan of attack was to keep the sediment in the Republican River and out of the Superior and Courtland Canals—which at first appears as a truism, but which in actual practice was easier said than done. True, the famed desilting works at the Imperial Diversion Dam on the Colorado River operate successfully in keeping sediment out of the All-American Canal, but the cost of constructing a similar desilting scheme for the Superior-Courtland diversion was prohibitive.

In their review of existing works the engineers' attention turned abroad to the several successful sediment control schemes for diversion dams developed by the Government of India. These control schemes consist of divide walls which split the stream of water, allowing clear water to run into the canal headworks and diverting the sediment-laden water downstream. Although the Indian rivers and divide walls are much larger than the Superior-Courtland diversion, the principles evolved and practiced applied substantially to the Republican River undertaking. Accordingly, from these studies of the Indian Government's developments came the specific approach to the hydraulic model studies on the Superior-Courtland Dam.

A model of the diversion dam one-fifteenth in size to the full-size structure was constructed in the laboratory, and experiments were begun on models of various types of divide walls. The goal constantly before the engineers was to develop a method of diverting as much of the sediment downstream and at the same time arrive at a solution which would be within reasonable cost limits to the project.

To keep the model as large as possible and thereby assure the greatest similarity between the model and prototype (full-size structure), one-half of the model diversion dam was tested at one time. The right half of the dam, which includes the Courtland headworks and sluiceway, was tested first. Experiments were then conducted on the left half, comprising the Superior headworks and sluiceway.

Sediment was fed in the model basin constructe upstream from the diversion dam, at a rate whic would duplicate the concentration of sand in th water of the Republican River. An electric vibra tor type of apparatus was used to allow an eve flow of sand to be dispersed in the water fro the supply hopper. A system of sampling th discharge of water and sediment in both the head works and sluiceways was also perfected so tha the rate and volume of sediment entering the head works of the canals could be detected immediatel The apparatus devised indicated the concentra tion of sediment in each of the samples taken fro the headworks and the sluiceway. Comparison o these concentrations for each scheme soon reveale the particular arrangement which would allow th least amount of sediment to enter the headwork

First tests conducted were those on the head works and sluiceways without the addition o divide walls. Then various modifications wer tried out on the model and were subject to exhau tive study. Without the divide walls, the tes disclosed that a higher concentration of sand en tered the headworks of the canals than the co centration going through the sluiceways and int the river below. Conversely, by adding the divid walls, the concentration of sediment entering th sluiceways was much greater than in the head works.

These tests clearly showed the advantage of d

RECEDING FLOOD on Republican River (below) shows curved steel sheet piling wall at Superior headworks. Right, silt bed in model of Courtland Canal. Below, E. J. Carlson (center) adjusting sluice gate on model of Courtland headworks, O. S. Hanson (right) regulating sand feed into dam as R. S. Brown (left) checks sediment samples. *Two photos at right by G. F. Breitung, Branch of Design & Construction, Denver, Colo. Photo below by R. Boyce, Bureau of Reclamation.*

ide walls in diverting coarse sediment from the anals' headworks. From this clear-cut picture of ediment action, the laboratory hydraulicians constructed models of two curved divide walls. One vall extended upstream between the dam and the Superior headworks; the other was placed athwart he Courtland headworks. Thus the curve principle of sediment division was evolved and adapted.

Stated simply, the principle is based on this act: If water is twisted or channeled around a urve, the sediment moving on or near the bed ends to move to the inside of the curve and is liverted back into the river below the dam.

On the basis of this laboratory work, two curved valls of steel sheet piling were subsequently driven ipstream from the Superior-Courtland Diversion Dam. The wall protecting the Superior Canal neadworks is about 50 feet long; the wall for the Courtland Canal headworks is over 100 feet long. Both walls are topped by a continuous concrete cap 0 inches thick.

By installation of these comparatively minor dditions to the diversion structure the relatively ediment-free portion of the stream flow is chanelled into the canals. Water carrying about twohirds of the sediment is twisted away from the eadworks and is carried away into the river.

The research engineers look upon the curved valls as a step forward in licking the knotty sediment problem on Reclamation projects. In the bast, water users have grudgingly accepted sediment as a necessary evil. However, the curve diversion walls appear as the most promising of several solutions in minimizing the influx of this lusive element into irrigation facilities.

To the water users who will benefit by the new Superior-Courtland Diversion Dam, the curved uide walls may be the answer to the endless cost nd effort in dredging thousands of yards of sediment that choke canals and laterals. THE END.

Work Started on Big Thompson Weatherproof Power Lines

During the next 14 months the Trans-Electric Co. of Louisville, Ky., will be constructing one of the country's toughest power transmission lines, on the 59-mile route over the Continental Divide between Gunnison and Salida, Colo., as part of he Colorado-Big Thompson project.

The contractors, who received the award in late March and were to start work within a month, will tring the 115-kilovolt, aluminum, steel-reinforced cable over some of the most rugged terrain in the United States. The line will begin at a point about 5 miles west of the city of Salida, and the contractors will use as many as 1,000 wood poles, from 50 to 75 feet high to support the aluminum lines. A 24-mile stretch crosses Monarch Pass (11,312 feet high) and while constructing this portion of the line the crews will be working at altitudes of 8,500 feet and higher. Four miles of this section will get special bracing, designed to hold up under 1¼ inches of ice, 60-mile-anhour gales, and 20°-below-zero temperatures. When the line is completed it will carry low-cost Colorado-Big Thompson project electricity to the city of Gunnison, REA cooperatives, and other preference customers in the area through wheeling arrangements with the Public Service Co. of Colorado. •

FIRST KANSAS DAM COMPLETED UNDER MISSOURI RIVER BASIN PLAN

CEDAR BLUFF DAM, on the Smoky River in Kansas, begun on April 1, 1949, is to be dedicated June 10, 1951. This multiple-purpose dam, combining flood control and irrigation features, will work in conjunction with Kanopolis Dam, also on the Smoky Hill River near Salida, Kans. An irrigation district is now in the process of being formed on the irrigable land just below Cedar Bluff Dam. It is the first dam to be completed in Kansas under the Missouri River Basin project plan, and is one of several dams proposed for control of flood waters in the Kansas River Basin. Other dams in the Kansas River Basin now completed, or near completion, include Bonny Dam in Colorado, Medicine Creek, Trenton and Enders Dams in Nebraska (all built by the Bureau of Reclamation), and Harlan County Dam, near Republican City, Nebr., being built by the Corps of Engineers. Among the dignitaries to attend the dedication are Congressman Wint Smith of Kansas, President of the National Reclamation Association Harry Polk, and Commissioner of Reclamation Michael W. Straus. ***Photo by N. T. Novitt, Region 7 photographer.***

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The Coming of the Kamloops

by T. B. GIBSON, Public Activities Officer, Shasta Dam, Region 2 (headquarters at Sacramento, Calif.)

MELVIN KENYON OF CENTRAL VALLEY landed a 16-inch fish just above Shasta Dam. He measured it, released it and reported the event to Henry Clineschmidt, of Redding, Calif.

The fish was a "kamloops"—a variety of rainbow trout transplanted from Canada to California by a group of sportsmen who saw the tremendous recreational possibilities of Shasta Lake. This group, headed by the aforementioned Henry Clineschmidt, calls itself California Kamloops, Inc., and has taken over the job of obtaining, rearing, and planting kamloops in Shasta Lake. The organization also does a great deal to encourage sport fishing in northern California.

Why did they select the kamloops? This fish, if properly fed, and in the proper environment, grows to a tremendous size, and furnishes the ultimate in fresh water fishing. The kamloops originated in Meadow Creek, a tributary of the Frazier River in British Columbia, where officials of the Fish and Game Department know of at least one record size kamloops taken in Jewel Lake—the fish weighed 52½ pounds, and probably measured from 3 to 4 feet in length.

No such size has yet been attained by the transplanted kamloops in Shasta. After all, some of them are less than 2 years old. The largest reported so far was a 22-incher taken at the Pit River Bridge this January. Mr. Clineschmidt is emphatic in stating that this program is experimental, and the organization does not expect an[y] great amount of "large fish" sport fishing unt[il] 1956. The immediate future should not produc[e] anything other than spotty "samples" of fishin[g] to come, and all fisherman are cooperating b[y] reporting their catches, measuring and releasin[g] the fish into the lake to grow to even larger siz[e]. All of the kamloops caught so far have been take[n] by people fishing for large mouth bass.

Shasta Lake is an ideal spot for the kamloo[ps] trout which thrive in deep fresh water lake[s]. These fish can only grow where the water is quit[e] deep and consistently cold. The few kamloo[ps] which have already been planted in the clear, col[d] waters of Shasta Lake, which is usually over 45[0] deep at the dam, appear to enjoy their new hom[e].

In June 1949, California Kamloops, Inc., pu[r]chased 2,119 kamloops eggs from the British Co[]lumbia Fish and Game Department. These egg[s] were hatched at the United States Fish and Wil[d]life Service's Coleman Station Hatchery on Batt[le] Creek. The fry were held and fed until the[y] were 1 year old. In June 1950, with the permis[]sion of the California Fish and Game Commissio[n] 1,319 kamloops up to 11 inches in length wer[e] planted in the main waters of Shasta Lake.

At the same time, another shipment of egg[s] (purchased by California Kamloops, Inc.), wa[s] received from British Columbia. A little over [a] fourth of these fish were hatched—26,994 out o[f] 100,000. This low ratio of hatched eggs was du[e] to the very advanced stage of the eggs when re[...]

eived. However, this second lot is now being ept and fed at Coleman Station. When they re 1 year old, in June 1951, they will join the rst-comers in Shasta Lake.

Besides clear, cold, deep water, the kamloops equires certain food in sufficient quantities if it s to reach maximum size. In November 1950, bout 6 months after the first kamloops had been laced in Shasta Lake, California Kamloops, Inc. mported 226,800 kokanee salmon eggs. The okanee is a variety of land-locked salmon which rows fast, and provides a fine source of food for he kamloops. In January 1951, 200,000 kokanees, vhich had been hatched and raised at Coleman Station Hatchery, were planted in the tributaries f Shasta Lake: Slate Creek, Dog Creek, Salt Creek, Big Backbone Creek, Squaw Creek, and eadwaters of the McCloud river. Unlike the amloops, kokanees are held only for about 60 to 5 days, at which time they are about 1¼ inches ong.

California Kamloops, Inc., plans to procure 00,000 kamloops eggs and twice as many kokanee ggs (600,000) per year for the next 5 years. The amloops will be hatched and held until they are earlings. The kokanees will be hatched and eld until they are 2 to 2½ months old and then vill be planted.

To do this job, California Kamloops, Inc., esimates their operating expenses at about $3,000 er year. This will cover the cost of eggs, shiping, medicine, and feed. Feed money is to be aid to the Fish and Wildlife Service. In the ast the Fish and Wildlife Service has "boarded" he kamloops free of charge as a gesture of good vill toward western sportsmen. But due to the reat number of fish to be reared in the future, t has become necessary to make other arrangenents.

The Shasta County Board of Supervisors has greed to appropriate $1,000 each year from Fish nd Game fine money for this venture. The Butte County Board of Supervisors has agreed to ppropriate $500 each year from the same source, nd Redding sportsmen have offered $500 each ear to help defray the expenses. The remaining money needed to operate will be raised by selling memberships in this nonprofit organization at $1 per year throughout the West.

Shasta Lake, now the cradle of one-time Canadian kamloops, should have some mighty fine fishing by 1956, and the story of this local-State-Federal cooperation in a project to improve what are called "recreational benefits" and "fish and wildlife propagation and conservation" is an illustration of what we mean by "multiple purpose" reclamation structures in the West. THE END.

IMPORTANT NOTICE!

Beginning with the July 1951 issue, the price of the RECLAMATION ERA will be raised to $1.50 for regular subscriptions, with a special rate of $1 for water users and Bureau of Reclamation employees. Subscriptions for persons residing outside the United States and Canada will be $2 a year. Renewals and subscriptions postmarked up to and including June 30, 1951, will be honored at the present rate of 50 cents for water users and Bureau employees, $1 for regular subscribers, and $1.50 for foreign subscriptions. Those postmarked July 1, 1951, and thereafter will be at the new rate.

We regret the necessity for raising the rate, due to production costs, which have increased despite many economy measures taken to reduce expenditures as much as possible and maintain the 40-year-old standards set by the Bureau of Reclamation's official monthly periodical.

INGERLINGS WEIGH IN—An employee of the Coleman Hatchery f the Fish and Wildlife Service near Shasta Dam weighing and ounting fingerlings prior to planting kamloops in Shasta Lake. hotograph by *J. E. Fluharty, Region 2.*

ROYAL PALACE in Bangkok is scene of leavetaking as Commissioner Straus shakes hands with Prime Minister Field Marshal Pibul Songgram of Thailand. At right is M. L. X. Khambu, Director-General of the Royal Siam Irrigation Department, a former Reclamation trainee.

RICE RAFTS made of teakwood float right over the spillway of th diversion dam on the Me Ping River in northern Siam. This is part the Me Fact project, 16 years old, serving about 40,000 acres, an providing much of Siam's most important crop—rice, plus many oth substantial benefits.

RECLAMATION STREET—26,000 Miles Long

PART 2—FROM INDIA TO THE UNITED STATES

by MICHAEL W. STRAUS, Commissioner, Bureau of Reclamation

India has 350 million people—more than twice as many as the United States, living on an area less than half as large. It has enormous water supplies, only 6 percent of which are utilized; plenty of tillable land; and an almost inexhaustible supply of labor. Because of past failures to develop water and power resources, its living standard is one of the lowest in the world; and the newly independent government is now seeking literally with the hands and muscles of its people to build the engineering works it needs.

India has been practicing irrigation for centuries, and it has more irrigated land than any other nation. It has some of the longest and most impressive irrigation canals on earth, and certain of its irrigation and silt-handling measures are superior to those in any other nation. Nevertheless, present irrigation is only a fraction of what is needed. Power developments lag still further behind. India has only 14 kilowatt-hour consumption per capita, compared with 3,000 kilowatt-hours per capita in America and many European countries, and most of this is confined to the great cities. There is very little coal and practically no oil; so further power development, and, hence, further industrialization, must depend largel upon hydroelectric developments. It is estimate that less than one-eightieth of India's hydro poten tial has been developed.

The Indians are working now on a tremendou program which cannot be completed for many de cades. They are building and planning some o the highest dams in the world. But these project are being built largely by hand labor. I sa 60,000 laborers, mostly women, working on on canal, each putting a couple of shovelsful of eart in a basket and carrying it away on her head Concrete mix is carried in the same way, about cubic inches each trip. These laborers are al employed by the Indian Government, which be lieves that if they are not thus employed, many o them would have to be supported in idlenes The Indian Government prefers to design and con struct its own works rather than employ foreig contracting firms under the limited-risk contract available. Realizing it will probably make man mistakes, the Government argues that only in thi way can it learn to build its own developments i the future.

One example of India's many ancient and ad mirable irrigation developments is the great Gang Canal, which takes off from the Ganges River b simple diversion works and extends well over hundred miles. This enormous canal has bee erving for more than a century and makes a major ontribution to India's food supplies.

Outstanding among the water and power de- elopments now under construction in India is he Bhakra-Nangal project on the Sutlej River, rogramed for completion in 1955 or 1956. Here, 80-foot Bhakra Dam, which will be the second ighest in the world, only 46 feet lower than Ioover Dam, is being built largely by human iuscle power. The project will irrigate 6½ iillion acres and provide 400,000 kilowatts of enerating capacity.

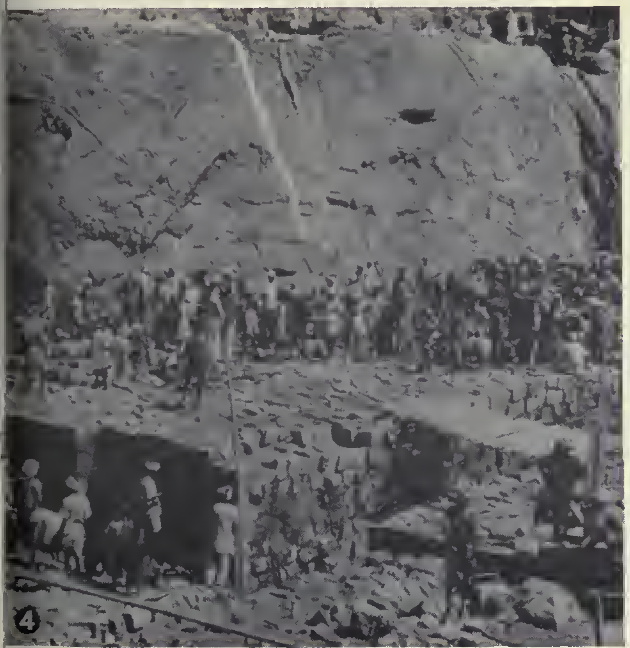
The Damodar Valley Authority, west of Cal- utta, is a frank copy of the Tennessee Valley uthority. It includes dams, 1,643 miles of irri- ation and navigation canals, power facilities, and n ambitious soil-conservation and resettlement rogram. One of its features is a 32,000-kilowatt hermopower plant which will help supply energy or India's only big modern steel plant, the Tata vorks. The DVA will irrigate 967,000 acres, enerate 240,000 kilowatts of hydroelectric power, nd provide flood control and navigation benefits.

The Mahanadi Valley development is another

NDIA'S A-BUILDING—(1) Rehobilitation necessary here too! Re- airing a diversion dam across the Ganges at Hardwar. (2) ydropower plont 75 miles south of Bangalore. (3) India's "TVA" known as DVA) placing concrete in foundotion of Tiloya Dam. 4) No lobor shortage here; hordes of laborers pitching in on ossive mosonry at Hirakud Dom. ***Photos mode from Kodachrome ides token by Chief Engineer L. N. McClellan of the Bureau of eclamotion.***

1

2



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NEW DELHI exhibit, above left showing a huge model of India, part of a 40-acre display in connection with the conferences. Outdoor hydraulic research laboratory at Pathankof, Amristar, at right. ***Photos adopted from Kodachrome slides taken by Chief Engineer L. N. McClellan.***

great Indian project. Only one of its three major dams is at present under construction; this one, Hirakud Dam, will be nearly 3 miles long and 150 feet high. The project will irrigate about a million acres and will provide 310,000 kilowatts of capacity.

The Tungabhadra project is being built by the two provinces of Madras and Hyderabad. Each province has its own complete crew and administration and builds out from its own side of the river, with every expectation that the dam will join together in the middle. The Madras side of the development will include a 225-mile canal and will irrigate 300,000 acres; the Hyderabad side will have a 140-mile canal and will irrigate 671,000 acres.

One of the vastest water projects ever considered anywhere, the Kistna Pennar project, is being proposed in the State of Madras. It would irrigate more than 3 million acres and develop large blocks of power.

In one area, however, India is making progress backward. Almost 5 million acres of once-productive land in the Punjab—a region which extends into both Pakistan and India—have been ruined by waterlogging and salting. Land is going out of production faster than it can be reclaimed. The main causes are overirrigation and canal seepage. In this region, after irrigation water is put onto the land, production is extremely high for perhaps 10 or 15 years. Then if there is careless irrigation the yields begin to diminish. Soon it is not worth while to harvest, and the land must be abandoned. The government has sunk hundreds of expensive tube wells to pump out the areas to be drained and use the water for further irrigation elsewhere. It is also lining some canals to prevent seepage. However, the Indian system of reducing the payments required for water on lands of poor yield does not encourage the best irrigation practices.

The island of Ceylon, now enjoying national independence, has an area of 25,000 square miles and a population of 7¼ million—that is, an area less than a fourth that of Arizona and a population 10 times as large. Here history brought forth a classic example of an ancient civilization which rose with irrigation and declined when the irrigation development was neglected. Some of the ancient "tanks," or reservoirs, are still functioning. The Minneriya Tank, which serves 11,200 acres that yield two rice crops a year, was built in 900 A. D.; the Parakrama Tank serves 21,000 acres and was built in 1200 A. D., and others have been in continuous use for as long as 1,500 years—which gives some conception of the enduring usefulness of a well-considered irrigation project. However, during dark years of war, conquest, and plague, some of the tanks fell into disuse, and many are still buried in jungle. Now the government is building new, modern irrigation developments.

The west and south sides of the island are well-watered. Here two-thirds of the people are concentrated. Though rice is their chief diet, their principal crops are tea, rubber, and coconut, which they sell on export markets so they may buy imported rice, to supplement the inadequate Ceylon-grown supply. The government wants to open the dry north and east sides of the island, settle them, and grow more rice at home. The Gal-Oya River Dam, being built by an American conracting firm (Morrison Knudsen International) vill irrigate 10,000 acres now in jungle, provide upplemental irrigation for 30,000 more acres, nd include 10,000 kilowatts of generating caacity. Though the dam and power house are lmost complete, the government development oard has not yet provided the canals or transmision lines nor finished its arrangements for settling he land. Each new settler will receive three acres f land, a house, and some cattle. He will be sked to repay a portion of the costs of these proprties, but none of the cost of the main works of he project.

Mr. Paul von der Lippe, Bureau of Reclamation ngineer, has been serving the Ceylonese Government as consultant in planning projects for 3 ears. The government needs and would like to ave further American help, particularly in project planning phases of its program.

The crown colony of Singapore has some rice rrigation, but inasmuch as military or quasinilitary operations against guerrillas are chronic, nd the government and the settlement are far rom tranquil, there seems little probability of ydroelectric or irrigation development programs n the near future.

Thailand (formerly called Siam) is about fourifths the size of Texas but has 2½ times as many eople. It has never been a colony, and its standrd of living is somewhat above that of adjoinng South Asian areas. The people live on a rice conomy and they need water-resource development for power and navigation as well as for ood. To a large extent, the rivers and canals are ised as highways.

A number of highly successful irrigation projcts are already completed and in operation, and 15 additional major projects are now in planning or construction phases. A World Bank loan of $19 million for constructing the country's first multiple-purpose project on the Chao Phya River has been negotiated. This project is expected to play a part in Siamese economic development comparable to that which the Boulder Canyon project has played in our own western development.

The dry northeastern section of Siam has some poor soils, low-living standards, and much malaria. Here a project is under construction on the Mool (pronounced *moon*) River which will irrigate about 40,000 acres of rice-paddy lands. In higher northern areas, which are generally more prosperous, the Me Fact project on the Me Ping River has been completed for 16 years and is serving some 40,000 acres with definite benefits already apparent.

Projects currently being completed will bring water to irrigate land at a capital cost of about $20 per acre. There is no provision for any repayment by project beneficiaries. The government believes that benefits to the Nation as a whole justify the government's paying all the costs. The Siamese situation is unusual also in that the country has no code of water laws.

The Royal Siamese Irrigation Department is one of the strongest and most independent units of the Thai Government, and 38 of its leading engineers have had trainee courses in America with the Bureau of Reclamation. Still more Thai engineers are in America now or will come in the near future. Under M. L. X. Khambu, Director General of the Irrigation Department, the Nation's water development program is being carried out by government forces without recourse to foreign contractors. Much of the actual work is done by human muscle. The government would like to have more American machinery and access to more American technical knowledge.

Hongkong, the island colony which has almost 2 million people on an area of only 391 square miles, relies on the development of its mountainside to provide domestic water for the city and irrigation water for the land. Every square foot of agricultural land is terraced and frequently irrigated by hand-carried water. Catchments, reservoirs, and canals are of a high order, but the possibilities of extending them are limited.

In the Philippine Islands, a considerable irrigation development alreadys exists and plans for more are being made. However, basic data, both economic and hydrological, are sadly deficient, and project planning hence remains a difficulty. Authority over water and related resources is widely scattered among government agencies. Though the government is not now in a position to obtain American technical aid, such aid will doubtless be needed in order to bring presently broached plans to completion. THE END.

Boke Becomes Member of United Nations Committee

Richard L. Boke, Regional Director, Sacramento, Calif., has become a member of the United

Nations permanent advisory committee on arid zone research. He attended an interim council meeting of the group, which is a unit of the United Nations Educational Scientific and Cultural Organization, in Paris last November, at which time plans for a permanent committee were adopted. The first meeting of the permanent committee was held in Algiers late in March. In addition to attending this meeting, Mr. Boke made a 4-day study tour of Sahara Desert irrigation stations. Jaime Torres-Bodet, Director-General of UNESCO, selected Mr. Boke as an individual on the basis of his long experience with water and soil problems in southwest United States and Latin America, and not as a representative of the Bureau of Reclamation. His term will be for 2 years, and his expenses will be paid by the United Nations. •

Lauro Dam to Serve as Regulator for Santa Barbara

The Bureau of Reclamation on April 5 awarded the contract for construction of the Lauro Dam to Clyde W. Wood, Inc., of North Hollywood, Calif.

The contractor will build a 110-foot-high earth-filled dam, near Santa Barbara, Calif., change the channel for San Roque Creek, relocate Laure Canyon Road, and clear the reservoir site to pro vide for 25 acres of surface water. The dan and reservoir will regulate the flow of an addi tional 10,300 acre-feet of water for the city' municipal system and provide additional wate for 29,650 acres of irrigated land in Santa Bar bara County. Work on the structure, an im portant feature of the Bureau's comprehensiv Cachuma project in southern California, mus begin a month after receipt of notice to procee and must be completed in 400 days.

The primary purpose of the Cachuma projec is to provide additional water to maintain exist ing irrigation, suburban and urban developmen and to permit future normal expansion of th city of Santa Barbara, along with Goleta, Mon tecito, Summerland, and Carpinteria Count Water Districts. In the water districts contin uous overpumping of underground water ha created a hazard of salt-water intrusion to th extent that one-third of the irrigated acres ma revert to dry-farmed status.

Construction of the Cachuma project will reliev the critical situation in Santa Barbara where us of city water exceeds the estimated safe yield fro the enlarged Gibraltar Reservoir. •

Carr Becomes First Full-Time Congressional Consultant on Reclamation


James K. Carr

Representative John R. Murdock of Arizona, Chairman of the House Committee on Interior and Insular Affairs, has appointed James K. Carr, former Sacramento Valley District Manager in the Bureau of Reclamation's Region 2, as Committee Consultant on Reclamation matters. Congressman Clair Engle of California, Chairman of the Subcommittee on Irrigation and Reclamation commented on the appointment by saying, "We are pleased to obtain the consulting services of Mr. Carr, who is an engineer with a wide background of experience in reclamation work. For the last 15 years he has been an engineer and administrator with the Bureau of Reclamation on California's huge Central Valley project, a outstanding example of diversified reclamatio problems."

Carr began his reclamation career with th Bureau on construction work at Shasta Dam i 1936. He later served as Assistant to the Re gional Director in Sacramento. In 1945 when h became District Manager at Chico, Calif., he ha charge of Shasta and Keswick Dams and powe plants, the 20,000-acre Orland project and studie of future water and power developments in north ern California. He was assigned to the Branc of Operation and Maintenance in the Commis sioner's Office in Washington, D. C., early thi year, from which position he resigned to sta work with the committee on April 2, 1951.

Carr is a native of Redding, Calif., a graduat of the University of Santa Clara, a member of th American Society of Civil Engineers, and a regis tered civil engineer of California.

Congressmen Murdock and Engle have state that Carr's services with the committee will no include participation in any of the hearings o consideration of the Central Arizona project. •

GRAND LAKE REGATTA

ON TOP OF THE ROCKIES—Sailboating at Grand Lake. At left is a miniature sailboat race, and above is the yacht race for the Sir Thomas J. Lipton Cup as seen from the Grand Lake Yacht Club. *Both photos by N. T. Novitt, Region 7 photographer.*

by MARCELLA ALLEN, Technical Expert, Region 7, Denver, Colo.

Every summer for the last 50 years one of the highest sailboat regattas in the world (rivaling only those on 12,506-foot-high Lake Titicaca in South America) has been held on the roof of the Rockies, near the Continental Divide.

Grand Lake, a natural jewel in the chain of lakes in the Colorado-Big Thompson project, where this dramatic show takes place, never rises or falls more than 1 foot. Since it became part of the Bureau of Reclamation project, its level, and that of Shadow Mountain Reservoir, has been stabilized by control works and by pumping from Granby Reservoir, another link in the chain of lakes in the project. To maintain this balance, Granby's waterline may vary as much as 94 feet during a season.

For generations, families have been coming to Grand Lake for their vacations, and the rim of the lake is dotted with luxurious summer homes. Thousands of people visit this lake high in the mountains (8,367 feet elevation) each tourist season. Almost 344,000 people enter Rocky Mountain National Park through the Grand Lake entrance each year. The little town of Grand Lake (600 in population in the winter, 20,000 in the summer) depends upon the tourist business for its chief means of support. Many kinds of sport are available to tourists, but the highlight of the season is the boat regatta, held under the auspices of the Grand Lake Yacht Club, with the $1,500 silver cup, donated by Sir Thomas J. Lipton, yachtsman, as the prize for the Lipton Cup Races. The name of the winner and his boat are inscribed upon the cup each summer.

This cup was awarded personally to the Grand Lake Yacht Club (organized in 1901 and incorporated in 1902) in Denver City (as it was known to the oldtimers) on December 3, 1912, when the Yacht Club gave a dinner at the historic Denver Club for the famous English yachtsman. By that time the event had attracted considerable interest. In the early days of the Yacht Club, before the coming of the railroads, the competing yachts had to be brought in over Berthoud Pass (elevation 11,314 feet) by stagecoach over rutty, snake-like roads.

The first yacht race was an example of pioneering. Harry Bryant, a Denver attorney, and Richard Campbell, son-in-law of Senator Patterson, met in competition purely in a spirit of fun, both using a sort of rowboat rigged with homemade sails. Mr. Bryant won. Thereafter, both men raced many times, with first one winning, then the other. Finally, the Bryants and the Campbells joined to provide the Colorado Cup, now an annual trophy at these tradition-weighted races. The first scow was brought in by Mr. Campbell, and the first real sailboat was imported by Mr. Bryant.

Grand Lake does not afford easy sailing by any means. The wind changes with mountain fury

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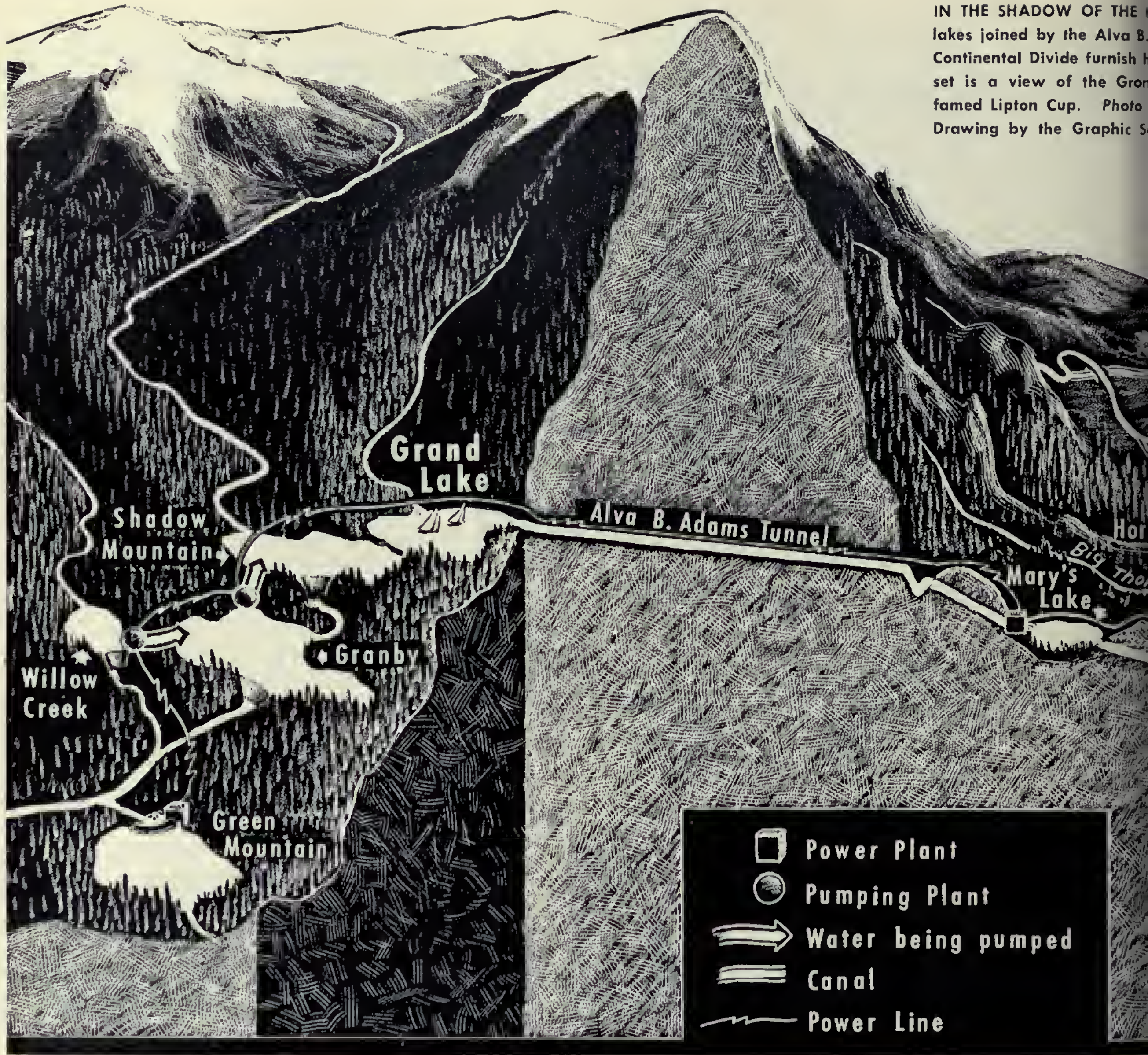

IN THE SHADOW OF THE lakes joined by the Alva B. Continental Divide furnish h set is a view of the Gron famed Lipton Cup. *Photo* Drawing by the Graphic S

and speed, and experienced yachtsmen are spilled in the icy waters of the lake along with the beginners. None of these upsets are as tragic as that of the Grand Lake legend. According to the ancient story, the Utes were fleeing from the Cheyennes and Arapahoes who were invading North Park. The Utes (who evidently believed in "women and children first") loaded their squaws and papooses on hastily constructed rafts, expecting them to escape across the lake, while the braves remained to repel the raiders. One of the unpredictable mountain storms struck the lake and all were drowned. The saddened warriors quit the place, and to this day the Indians say the sighing of the pines is the wailing of the lost families.

Nowadays, the nattily rigged, sleek yachts bear little resemblance to the first sailboats, which were rigged-up rowboats, with a pine tree for a mast and bed sheets for sails. The whole event is carried on in the height of tradition and formality. The present commodore is Earl Coryell of Lincoln, Nebr. In a few instances a father and a son have had the distinction of having been commodore, each in their time. A year ago Richard Campbell, the son and grandson of two past commodores, Thomas Patterson Campbell and Richard C.

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Campbell, was entered in the race for the Sir Thomas Lipton Cup.

Grand Lake is only one of many lakes on Bureau of Reclamation projects that offer unlimited recreational possibilities. On the east side of the Divide is Estes Park Lake, an artificial reservoir, another unit of the Colorado-Big Thompson project. It, too, has a great resort potential. The village of Estes Park has enjoyed a tourist population for many years but only now is the lake area becoming developed.

Over the tunnel, between the two lake sites, runs Trailridge Road (elevation at the pass is 12,183 feet). The opening of the road is marked each spring with a ribbon-cutting ceremony, amid snow banks and warmly clothed observers.

Alcova Reservoir, about 30 miles upstream from Casper, Wyo., is another lake that has had a boat regatta almost every year since 1936. Alcova has a rock-bouldered canyon for a shoreline, created by damming the North Platte River. It is located in a region where other recreation spots are not plentiful.

Also on the North Platte River are the Big Seminoe and Pathfinder and the smaller Guernsey Reservoirs, all in Wyoming.

(Please turn to page 129)

FUTURE FARMER OF AMERICA Lee Watenpaugh and one of the young registered Jersey heifers he is raising on his dad's farm in Meridian, Idaho, in addition to his farm chores and his public speaking. *Photo by Phil Merritt, Region 1 photographer.*

"Irrigation's Unsung Benefits"

A 17-Year-Old Farmer Looks at Federal Reclamation

EDITOR'S NOTE.—In a recent Southwestern Idaho District Oratorical Contest, Lee Watenpaugh, Meridian, Idaho, spoke on the subject "Irrigation's Unsung Benefits," and paid Federal Reclamation quite a tribute. A condensation of his inspiring talk is given here. After school, this 17-year-old youngster milks 11 registered Jerseys and runs 17 sheep and 20 head of cattle on a suburban 16-acre farm, owned by his dad, who works in Boise. Lee is vice president of the Ada County American Jersey Club, secretary of the Meridian F. F. A., and is milk tester for the Veterans' Administration in the county.

by LEE WATENPAUGH, Future Farmers of America, Meridian, Idaho

WE, THE FUTURE FARMERS OF AMERICA, who live in the West, are ever conscious of the bountiful production of our irrigated lands which were reclaimed through the tireless efforts of men of vision and fortitude. Out of the deserts 20 million acres have been reclaimed. It is estimated that 20 million more acres can be made to bloom with the magic touch of water.

Without these presently developed lands the West would not be as we now see it; a West with its many green valleys set as emeralds in the gray

"THE MAGIC TOUCH OF WATER"—A scene which indicotes the direct benefits of irrigotion—a field of hybrid sweet corn seed south of Nompo on the Boise project. Behind this scene ore other importont but often overlooked benefits pointed out in this orticle by o young former who knows whereof he speoks. *Photo through the courtesy of the Crookhom Seed Co., of Coldwell, Idoho.*

deserts which surround them; green valleys sparkling in the evening with myriads of scattered lights; lights in homes where wives prepare meals for hungry husbands and ravenous children; lights in barns where strong, healthy men finish the work of the day before enjoying the quiet peace of the evening. Such scenes indicate the direct benefits of irrigation, the benefits we can readily see and understand.

In these same green valleys, however, are also clusters of lights; clusters of lights that mark the places where, during the day, many people work, shop and play; places that have come into being because of the surrounding rich farm lands. The inhabitants of these villages and towns are the people who handle the farm produce for local use and for distribution throughout America. In turn these people, as well as their country neighbors, use products raised or manufactured in other parts of the United States. This creation of wealth, furnishing of employment and making possible the establishment of better, more successful homes are the hidden benefits I wish to mention. They are benefits we take for granted; benefits we too often overlook.

In the year 1900 a tricounty area in Idaho, composed of Twin Falls, Minidoka, and Gooding Counties, had fewer than 6,000 inhabitants and only 48,000 acres under cultivation. By 1940 the population had increased to 84,000 people and 627,000 acres of irrigated land had been added. Is this increase not impressive? Eighty-four thousand people in an area which had previously supported only 6,000!

In this area over one-half of the people live in towns a ratio of approximately one town person to one in the country. These townspeople, over 45,000 of them, are benefiting from irrigated agriculture.

If you wish these benefits to be stated in terms of dollars and cents, the records show that for every dollar invested in the farm, slightly over a dollar is invested or created in the form of urban, railroad or public utility property. Moreover, for every dollar invested in country property over a dollar is received every year by city folks in the form of fees and payrolls, all because the irrigated farms produce so abundantly.

There is no way to measure, with much accuracy, how these indirect benefits affect the people elsewhere in the United States. We do know, however, that the people of irrigated areas must have furniture, farm machinery, automobiles, gasoline, oranges, and like products. The best estimate available is that it takes at least one person outside the area to provide these things for each person within the irrigated area.

A commentary on benefits to the Nation is that during the last 21 years the people of major irrigated areas in the Pacific Northwest have paid into the United States Treasury enough income taxes alone to equal the cost of constructing the projects. What a tremendous amount must also be realized from revenues collected beyond this tax!

Fabulous as it may seem, the indirect benefits of irrigation development do not end here. In the development of water for these farm lands, great dams, the largest in the world, are built to impound water for release to hungry acres. Advantage is taken of this stored water to develop much needed power. Power produced by water that cascades through giant penstocks into turbines which in turn revolve tremendous generators that whirl day in and day out to produce electricity. Electricity to light homes. Electricity to turn the wheels of industry. Electricity for security purposes to keep America free and strong.

The purpose of constructing the Grand Coulee Dam was to bring a million acres of land in the State of Washington under irrigation. However, it also made possible the production of power. It was because of the power produced from waters behind this dam that the production of the atomic bomb became possible. It was partially because of this power that aluminum, much needed to build airplanes for World War II, could be produced.

In addition to these there are still other benefits. Crystal clear streams and reservoirs teem with trout for the sportsmen's enjoyment. Great dams hold back the spring runoff and thereby prevent disastrous floods, and regulate the rivers for navigation.

Having recognized these tremendous benefits, both obvious and hidden, that are created through the development of irrigated lands, is there any doubt what should be the destiny of those millions of acres still thirsting for available water? The great task of developing those thirsty acres rests upon our shoulders—both the present and future farmers of America. We farmers must work in close cooperation with our city neighbors, for they too must share this great responsibility. What a challenge to us all to serve our community, our Nation, yes even the entire world, in performing this inspiring task. THE END.

Work on Flatiron Power and Pumping Plant Under Way

The Bureau of Reclamation awarded a contract to Winston Bros. Construction Co. of Monrovia, Calif., on April 11 to build the Flatiron power and pumping plant, dam, afterbay, and appurtenant works. This feature of the Colorado-Big Thompson project will have one of the highest water drops on any Reclamation project. The 1,055-foot waterfall will shoot out from Bald Mountain tunnel, enter the Flatiron dual purpose plant, which will churn water through the turbines for hydropower and also pump irrigation water into Carter Lake for irrigating thirsty acres in northeastern Colorado. Another unusual feature of the development is the use of the Francis type wheel or reaction wheel for a head in excess of 1,000 feet. Heretofore the Pelton type turbine or impulse wheel has been used exclusively on heads exceeding 1,000 feet.

For the second time in reclamation history, a pumping or generating unit has been called upon to serve in a unique dual role. During slack periods of the day, when the demand for irrigation water has been met, the 10,000-kilowatt unit will be thrown into reverse. Instead of pumping water into Carter Lake, the Flatiron unit will draw upon the reservoir reserve to generate power for peak load demands. The other similar Reclamation installation is located in Utah on the Strawberry Valley project which the Bureau started constructing in 1906. •

Security Restrictions on Shasta Tours

Although stringent security measures have been in effect since last year at Shasta and Keswick Dams, supervised guided tours of Shasta Dam will be continued on a limited basis.

The public will be escorted across the dam roadway, down the passenger elevator, and to the north entrance of Shasta power plant on regularly scheduled tours. This will allow a view of the plant's interior without close proximity to vital installations.

Other vital areas at the Shasta Dam and power plant will be closed to the public, and additional guards have been posted on a 24-hour basis.

Reclamation officials have ordered Keswick Dam and power plant, 9 miles downstream from Shasta, closed to the public, and additional guards posted there. Entrance to vital installations at Shasta and Keswick will require passes approved by the operations superintendent at Shasta Dam. •

HOME IN THE WEST—on the Roza Division of the Yakima project in eastern Washington, shown above, with World War II Veteran Richard Ormiston and his father. Five years ago the farm looked like the photo at left—80 acres of sagebrush—when Private Ormiston was on leave from the hospital, having been wounded in combat on Mindora Island. Now he and his father have an attractive home on this once barren land, and productive fruit orchards.

Construction Resumed on San Joaquin

Regional Director Boke, Sacramento, announced early in March that the Bureau is resuming construction of irrigation distribution systems in the San Joaquin Valley. This announcement was made after California's Attorney General Edmund C. Brown reversed his predecessor's position and supported the validity of the 40-year contract between the Ivanhoe Irrigation District and the Government, pending before the Superior Court of Tulare County.

The Bureau halted its construction plans when the validity of the contract was attacked in the courts with the support of former Attorney General F. N. Howser.

The controversy involved the construction of a 2,700-mile distribution system from the Madera and Friant-Kern Canals. •

PG & E Signs Wheeling Contract for Central Valley Power

On April 2, 1951, a 10-year contract was executed between the Pacific Gas & Electric Co. and the Bureau of Reclamation to carry Central Valley project power over P. G. & E. lines in the Central Valley of California.

Under the terms of the contract, power generated at Bureau plants in the Central Valley project will be delivered to the company system at Tracy, Calif., whenever excess carrying capacity is available, and be transmitted to preference customers of the Government in the Sacramento and San Joaquin Valleys and in Solano, Contra Costa, Alameda, and Santa Clara Counties. The Government will pay P. G. & E. for this wheeling service at specified rates. •

SHORT CUTS TO WEED KILLING CALCULATIONS

PART 3—RAISING THE BOOM

Did you know you could spray your weeds, crops, or insects twice, using the same amount of chemical per acre simply by raising the boom of your spray rig?

How high to raise the boom is a question you can answer easily by referring to the nomogram included as figure 9 in the "Handbook of Weed Control Calculations" written by John T. Maletic, Soil Scientist and Weed Control Specialist of the Bureau of Reclamation's Region 7, in Denver, Colo.

This is the third in our series of articles demonstrating the use of the handy charts or nomograms in Mr. Maletic's book which contains methods for quickly figuring the calculations needed for applying chemical weed killers. In many cases, these nomograms can also be used for calculations included in spraying crops for diseases or for insect control.

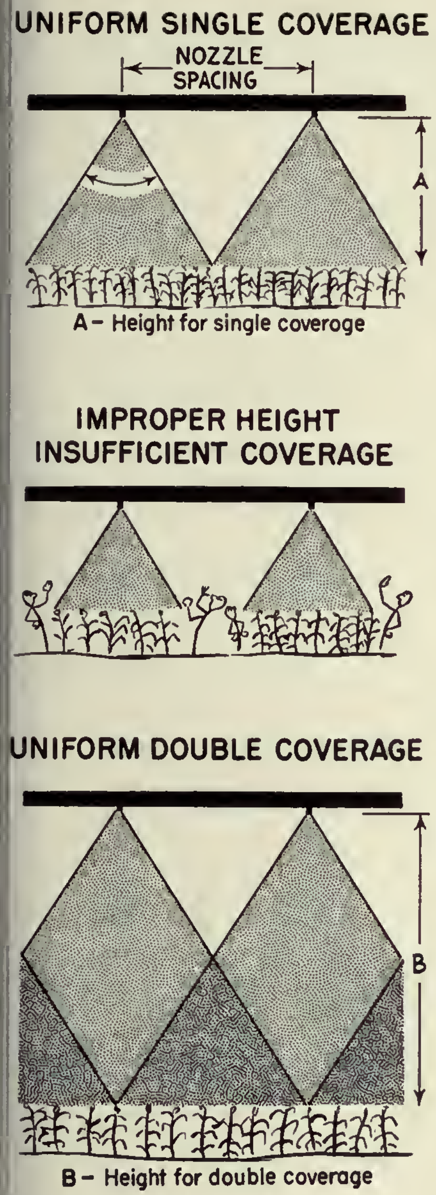
Figure 9 which appears on the next page entitled Nomogram for Determining the Height of Boom Required to Obtain Single or Double Coverage of Spray Above Vegetation, can help you to make sure of getting an even application of spray solution on the weeds you want to kill. If you do not have the spray boom and nozzles at the proper height above the weeds you may get too much chemical on some strips and not enough on others. Single coverage with a low boom, where the fanlike sprays just meet above the weeds, may be necessary on windy days or where the spray might drift and endanger nearby crops. For the same reason, the boom must always be kept at exactly the correct height, neither too high nor too low, for all applications, whether single or double coverage is intended.

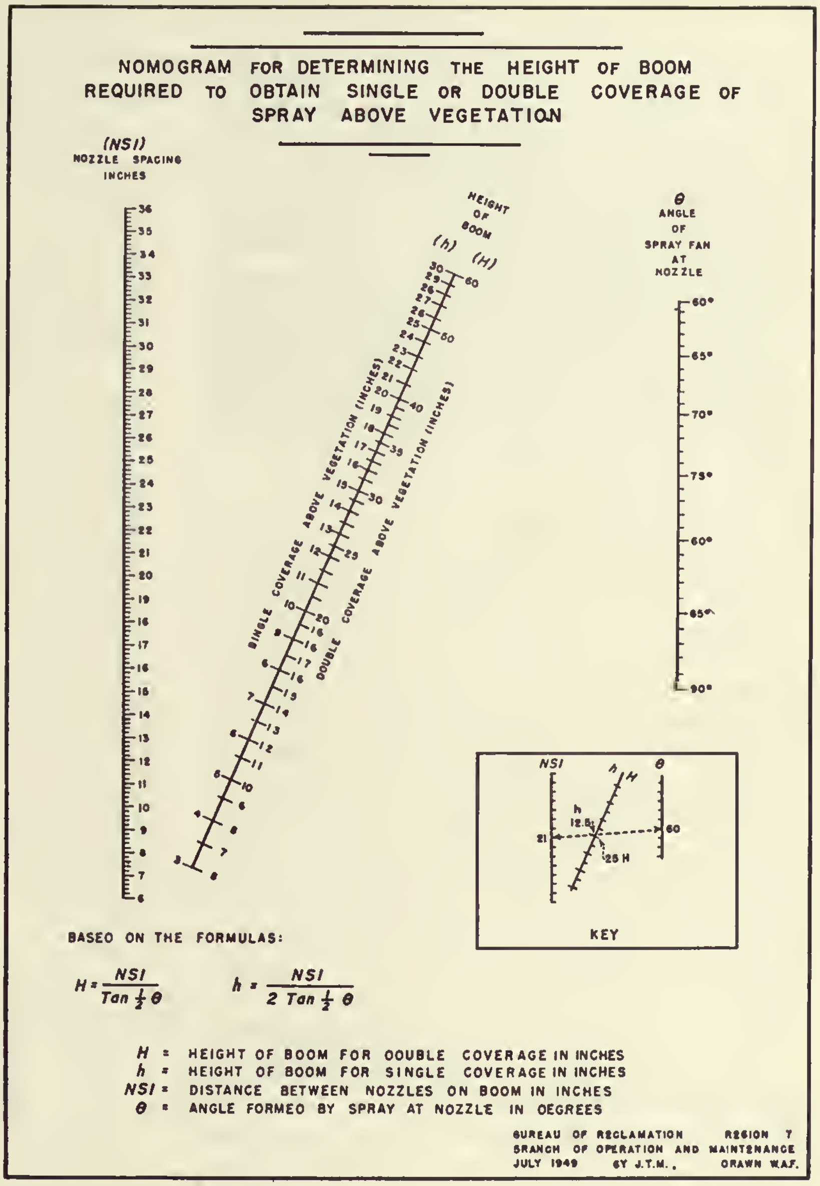
Double coverage, using the same amount of chemical per acre, distributes the sprays more uniformly and helps eliminate the possibility of leaving unsprayed strips. Each strip of plants is covered by spray from three nozzles, getting half the spray from each of two nozzles and all the spray from one. As the spray fans out and the rig travels over the plants, each plant is thoroughly drenched. An additional advantage to double coverage is that it is especially good for operating on rough ground where the boom height changes.

To use the chart you will first have to find out how many inches apart the nozzles are spaced on the boom, and at what angle the nozzles deliver the spray. Just measure the space between the nozzles and look at the markings on the nozzles themselves—the angle is usually marked on each one, 60°, 90°, etc. However, the angle of the spray varies somewhat with the pressure used, high pressure spreading out the angle of the fan, and low pressure reducing its spread, just as it does in a water faucet. It is a good idea to get a chart from the manufacturer of the nozzles which will show you the angle they will give at the pressure which you have at the boom. The angles of many of the nozzles obtainable on the market are rated at around 40 pounds pressure.

Suppose you find your nozzles to be spaced 21 inches apart (as illustrated in the key in the corner of the nomogram) and you learn that under the pressure you will use, your nozzles will deliver the spray at an 80° angle? Simply take your straight edge (a transparent one is best) and connect the figure 21 on the left hand scale (NSI, short for Nozzle Spacing in Inches) with the figure 80° on the right-hand scale (θ, the Greek letter theta, often used as a symbol for "angle"). The answer will be found at the point where your straight edge or rule crosses the center diagonal scale (small h for single coverage, capital H for double coverage). In our example, you would set your boom 12½ inches above the weeds to get single coverage, or 25 inches above the vegetation if you want double coverage. As a matter of fact, the height of the boom for double coverage is just twice as much as for single coverage.

To figure the height of your boom from the ground up, now that you know the distance from the top of the weeds, simply measure the height





HOW HIGH THE BOOM is raised above the tops of the weeds determines how effective your spraying campaign will be. You can use the nomogram to figure the height of the boom and it is up to you what kind of a dose to give the weeds, using the same amount of chemical. The weeds at the top of the page are being well covered, but those below may escape the deluge. Those at the bottom haven't got a chance. *Nomogram from "Handbook of Weed Control Calculations" by John T. Moletic. Drawings by Graphics Section, Washington, D. C.*

of the weed growth and add that to the answer you got from the chart.

For double coverage, or 100 percent overlap of the spray, be sure the edge of the spray from one nozzle does not strike the spray of the nozzle next to it, and spoil the spray pattern, dispersing the conflicting sprays in all directions. Staggering the nozzles on alternate sides of the boom, or tilting the angle of the nozzles will avoid this occurrence.

(Reprints of this series, in the handy page size of the ERA*, are now available. Send your requests to your nearest Regional Director. See inside back cover of this issue. Reprint #1 was based on the nomogram which tells you how to get the most for your money when you are buying liquid weed killers. Reprint #2 was entitled "Finding the Killer in the Dust" and served the same purpose for weed-killing dusts or powders.)*

Natural Resources "Not Expendable," Says Chapman

Secretary of the Interior Oscar L. Chapman recently warned all heads of bureaus and offices in his Department that treating resource conservation programs as expendable luxuries in the national emergency would jeopardize the basic economic foundations upon which our long-range military security and peacetime welfare depend.

The Secretary declared that the problems of building up the military machine have quite properly demanded first attention since Korea, but he also asserted, "This, however, is only the first step in our defense program. The second or long-range phase of this defense effort calls for the maintenance of a high level of military preparedness without jeopardizing the economic strength of the Nation."

In urging all Interior officials to give renewed emphasis to the Department's vital responsibilities, the Secretary outlined three basic steps: (1) Cooperate fully with the work of the Materials Policy Commission established by the President to study broad, long-term aspects of the Nation's materials problems, (2) stress departmental efforts in long-range resource planning and programing to firm up needs and goals in the light of the world situation, and (3) improve machinery for translating identified needs into action proposals for consideration of the President and the Congress. •

First Missouri Basin Contract for Kansas OK'd

Assistant Secretary of the Interior William E. Warne executed the Kansas-Bostwick Irrigation District contract on April 20, on behalf of the United States. This is the first Missouri Basin project contract negotiated in Kansas and provides for the irrigation of 49,000 acres in the northern part of the State on the Bostwick Division of the project.

The Bostwick Division of the Missouri Basin includes about 100,000 acres in Kansas and Nebraska (See "The Bostwick, Nebraska, Contract," Reclamation Era, May 1949 and "Bostwick Unit" Reclamation Era, December 1950) which will receive the main water supply from the Harlan County Reservoir being built on the Republican River near Alma, Nebr., by the Corps of Engineers.

Kansas District water users will pay an annual rental for water service and, at the close of a 5-year development period, start repayment to the Government of $3,500,000, which represents the cost of the district's water distribution system and will be paid in 40 equal annual installments.

The Kansas-Bostwick District has been divided into irrigation blocks which will permit orderly development in accordance with construction progress on the project. Present plans call for the initial delivery of water through the Bostwick pumping plants in 1952 and completion of the project in 1958. •

Sixteenth Central Valley District Seeks Irrigation Water

When Secretary of the Interior Oscar L. Chapman approved the form of the long-term water service contract with the Contra Costa Water District it marked the sixteenth district which has negotiated for irrigation water on this project. The contract has been sent to the water users for acceptance.

Negotiations are now under way with more than a score of other districts for sale of Central Valley project water and all of the Friant-Kern supply has been either contracted for or committed for future use. Under the Contra Costa contract a maximum of 86,000 acre-feet will be delivered annually for agricultural, municipal, industrial, and domestic use. Over 7,000 acres will receive 63 percent of the water for supplemental irrigation.

Under previously executed contracts eight Central Valley irrigation districts received supplemental water for the first time in 1950. These districts received 103,677 acre-feet of water during the year, representing almost 22 percent of the total amount of water used to irrigate 172,205 acres. On these lands $46,620,801 worth of crops, mostly fruits, nuts, forage, and cotton were grown, amounting to an average per acre return of $260.16. This is based on the net area in cultivation—179,201 acres. •

Hungry Horse Fills Blood Bank

On Thursday, April 5, 1951, the people working on the Hungry Horse Dam and power plant in Montana chalked up another record for this history-making project.

They donated 208 pints of blood to the American Red Cross, which according to Dr. Paul McBride, in charge of the American Red Cross blood-mobile unit from Great Falls, Mont., represented one of the most successful blood-donor programs ever held in that State. •

GRAND LAKE REGATTA

(Continued from page 121)

Along the Republican River in Nebraska, more lakes are being created by new Bureau of Reclamation projects. Like the Wyoming lakes, they are coming into being in an area where few lakes or other recreational facilities exist. There are Enders Reservoir, Swanson Lake, Medicine Creek Reservoir, and Harlan County Reservoir, the latter now under construction by the United States Corps of Engineers. Coming up in the near future will be Horsetooth, Carter Lake, and Willow Creek in Colorado, and Cedar Bluff in Kansas. These areas are being eagerly developed to provide clean family fun throughout the whole of the Reclamation West. These recreational benefits are among the multiple purposes of Reclamation-built structures. THE END.

In Memory of George Albert Smith

The RECLAMATION ERA hereby pays tribute to, and mourns the passing of, George Albert Smith, president of the Church of the Latter Day Saints, on April 5, 1951. To his successor, David O. McKay, Secretary of the Interior Oscar L. Chapman wrote, "the world lost one of its great spiritual leaders and humanitarians in the death of your beloved president, George Albert Smith. I shall always treasure the afternoon he spared me for a visit in Washington last year and mourn with you and the members of your church in his passing."

Commissioner of Reclamation Michael W. Straus sent the following telegram to new leader McKay, "The leadership of George Albert Smith in the conservation and development of the natural resources of the West for the benefit of humanity is well known. Like the other great leaders of your church, he had a keen interest in making the desert 'blossom as the rose,' and only last year discussed with me personally plans for the Upper Colorado River development as another step in this great effort. We, in the Bureau of Reclamation, join with you in mourning the passing of a great man."

NEW HEADQUARTERS FOR COLUMBIA RIVER DISTRICT

FINISHING TOUCHES and cleanup work just before the Columbia River District employees moved into their new headquarters at Ephrata, Wash. The flagpole at left had yet to participate in a flag-raising ceremony. ***Photo by Ellis Sharthill, laboratory technician, Columbia River District Office.***

On April 22, 1951, Bureau of Reclamation employees officially moved in to the new headquarters building of the Columbia River District in Ephrata, Wash. Previously, part of the district staff worked in temporary quarters. Others traveled daily between Ephrata and Coulee Dam, commuting the 60-mile distance. Eight divisions in all moved into the new building; programs and finance, personnel, land acquisition, information, legal, supply, project development and safety. The project development division had been stationed a quarter-mile to the southeast of the new building. The irrigation construction and operation and maintenance divisions will move into the quarters vacated by the project development staff.

H. A. Parker, District Manager, who has been commuting to Coulee Dam since his appointment on October 21, 1950, will now be "at home" on the second floor of the Headquarters Building at "C" and Division Streets. Phil Nalder, Assistant District Manager, has come down from Coulee Dam, where all remaining responsibilities at the dam are under the direction of A. F. Darland, Supervising Engineer of the Coulee Dam Division.

With this move, the Bureau employees will be able to give on-the-spot service to the irrigation farmers and people in the area who have dealings with the Bureau in connection with the fast-growing Columbia Basin project. •

WATER REPORT

May first forecasts of 1951 water supplies for Western States promise to depart but little from the April first forecasts released in the RECLAMATION ERA. According to the latest snow survey information released by the Soil Conservation Service and its cooperating agencies, the northwest may still expect adequate and perhaps excessive runoff in a few localized areas, and the northern tier of inter-mountain states also will fare very well for water. The southwestern drought was not relieved during April.

Sectional forecasts based on May first snow survey data are summarized in the following paragraphs:

COLUMBIA BASIN—Above normal snow pack that existed at the end of March has been considerably reduced, particularly at lower elevations by high April temperatures. These high temperatures have probably been accompanied by high evaporation losses. This, together with abnormally low precipitation during April, will result in runoff somewhat less than that forecasted April 1. It is estimated that the inflow to Okanagan Lake will be 10 percent less than that forecast. The amount of reduction in other basins of British Columbia will probably be very small.

The water supply outlook for irrigation and power remains good to excellent throughout the basin.

In general, snow cover throughout Columbia Basin is still above normal, although proportionately lower than on April 1 due to the warm, dry spring prevailing to date. Potential high water on the Kootenai, Methow, and Okanogan rivers was reduced by the high flows during April. However, these rivers may still rise to dangerous levels and precautionary measures should be taken to protect vulnerable areas.

With the exception of western Montana, valley precipitation throughout the basin was far below normal for April, which reduces the seasonal volumes of water forecast on April 1 by about 6 percent.

A heavy storm April 28–30 deposited twenty to forty inches of snow on the higher elevations and eight to ten inches of snow at lower elevations in western Montana. The Flathead river should flow about 150 percent of average during this season. The Clarks Fork river should flow at least 130 percent of average. These flows will be less than in either 1950 or 1949. In the Upper Columbia river basin of Montana, water supply for irrigation and power will be sufficient this season for all needs.

UPPER MISSOURI—May 1 snow surveys on the Upper Missouri and Yellowstone rivers in Montana indicate an excellent irrigation water supply for this coming season. The May first snow pack on headwaters of the Yellowstone river is above average and a good water supply is anticipated for the Yellowstone Valley. May–September flow at Corwin Springs should reach 1,770,000 acre feet or 7 percent above the 10 year average. Snow pack on the Jefferson is heavier than last year, while on the Madison and Gallatin is less than last year, but slightly above average.

Snow surveys on the Musselshell and Judith rivers indicate runoff slightly below average in prospect. However, spring and summer precipitation play a very important part in the water supply from these midstate mountain ranges.

May 1 snow surveys on the Wind and Popo Agie river basins indicate a good water supply for those basins for this season. The Wind river above Riverton is likely to produce a record year's runoff. Reservoir storage on Missouri river in Montana is good, along with the storage in northern Wyoming. Those portions of eastern Montana not supplied by snow fed streams are beginning to feel the effects of the deficient precipitation over that section during the winter and spring months. The October–April precipitation over eastern Montana is 63 percent of average.

ROCKY MOUNTAIN STATES—Colorado water supply outlook has not changed materially since April first. The snow cover on the South Platte remains great. In many cases the snow cover is greater than any since snow surveys began. Areas of heaviest snow cover are on the headwaters of Boulder Creek, Clear Creek and Thompson river. The extreme headwaters of the Arkansas are also very good, but some of the southern tributaries are deficient in snow. The Blue river drainage, tributary to the Colorado, is still unusually high in snow cover. The southern part of the state continues definitely deficient in snow. Streamflow throughout the area is g erally below normal due to delayed sn melt.

Snow cover on the Green river Wyoming is as great or greater in so cases than last year when it reach record maximum. Precipitation duri April approximately was normal in t high watershed of the Snake river western Wyoming. No change in t seasonal runoff as forecast on April Good water supplies are forecast for t Jackson, Wyo. area and adjacent lar below in Idaho.

The water outlook for Rio Grande New Mexico continues to be critica poor, with practically no snow and w below normal precipitation during Apr

INTERMOUNTAIN STATES—In gener there is no major change in the wat supply prospect for Utah. The fi half of April was dry with high temp atures which accelerated streamflo About mid-April, cool temperature still continuing, reduced streamflow that runoff for April has been on normal or below, even in areas whe total seasonal runoff is still expected be considerably above normal. Pr cipitation for April as a whole was no mal or above. Therefore, about th same runoff as forecast a month ago expected to occur.

May first measurement of key sno courses indicates that very damagi peak flows may still occur in Norther Utah.

In Southern Utah, high precipitatio at the month's end only slightly in proved water supply prospects. Strea flow here will still be near a record lo Indicative of southern Utah is th Beaver river. Only 4 times in the las 38 years has streamflow been as low o lower than it was this April.

The drought in central and souther Nevada continues. There has bee little improvement during the pa month in the outlook for irrigation sea son water supplies. Above norm mountain snowfall during April ha very slightly improved the prospects but in all areas except for Humbold Basin snow water conditions on May were far below normal. Cool weathe during April, and above normal precip tation in valley areas reduced the Apri demand for irrigation water. This wa helpful in conserving limited store supplies for use later in the season.

PACIFIC COAST—Marked lack of rai fall and abnormally heavy snow mel l snow evaporation during April re-ced prospective runoff for most of egon's streams. However, most of e State can still be confident of good ter supplies, although late season ficiencies of water are now expected many small streams deriving supply m low elevation watersheds. Water red in reservoirs is 5 percent above erage for May 1, but in a few im-rtant reservoirs supplies are below rmal.

The over-all April-July streamflow pectancy for California, as a result observations of snow courses, precipi-ion, temperature, and antecedent noff made during April, shows that ficient irrigation water will be avail-le on the main stem of the Sacra-nto River; while on all of the rivers the south, deficiencies will occur. On e Kern and Kaweah, the water de-iencies will be the greatest of record.

SOUTHWEST—The water supply out-ok for Arizona has not improved since ril first. Combined total reservoir rage is 2 percent less than a month o, the combined storage being 5 per-nt of capacity or 170,000 acre feet. wever, due to general mountain owfall near the last of April in one rge storm, the forecast of February–ne inflow to major reservoirs is in-eased from 140,000 to 150,000 acre et.

No change is reported in water allot-ents for 1951 in Gila and Salt River ojects, nor in the acreage being eded. Salt and Verde Rivers still w close to their minimum base.

(The above was submitted by R. A. ork, research project supervisor, of e Federal Cooperative Snow Surveys.)

CROPS

inidoka Crops Near $64,000,000

Farmers on the million-acre Mini-ka project in the Upper Snake River lley in southern Idaho raised crops lued at $63,900,173 during 1950.

While this return was considerably low that of the peak year 1947 it com-red favorable with 1949's gross of 6,716,944. The average gross per acre turn was $64.75 compared with $67.91 1949. Lands receiving both full and pplemental water supplies from Rec-mation constructed facilities were cluded in the roundup.

Wheat brought the highest gross re-turn ($15,174,210) while sugar beets led as the highest per acre crop ($135.41). Alfalfa hay was second in gross value and potatoes third. The Twin Falls Canal Co. led in gross re-turns for individual districts with $14,669,000 for 202,700 acres, an aver-age of $72.37 per acre. ●

Boise Crops Hit 25¾ Million

When the final results were tallied on crops grown in the Boise Reclamation project in Idaho during 1950 they re-vealed that the total value was $25,744,938.

This amount represented crops grown on 306,644 acres served by Reclamation facilities. About two-thirds of the land received a full supply of water while the other third received supplemental water. The gross per acre average value for all crops was $83.96 compared with the all-time high of $104.21 in 1948.

Sugar beets topped the list in gross values showing a total of $5,184,255 or $171.69 per acre for 30,195 acres. Al-falfa was second with a total value of $4,267,379 and wheat was third at $2,554,225.

Pasture and cherries also hit the million-dollar mark, with cherries ex-ceeding the $550 per acre value. How-ever, the highest gross per acre return came from hops, almost $882 per acre for approximately 1,000 acres. One-quarter of the project was in alfalfa, wheat was next in acreage, and sugar beets third.

Farmers in the Black Canyon Irri-gation District, newest of the Boise project developments, are continuing to increase the acreage under culti-vation and the per-acre gross return. In 1950 they produced crops valued at $465,000, or a per acre average of $39.03, on approximately 12,000 acres, com-pared with what they raised in 1949 on 5,500 acres. In that year crops were valued at $184,000, or $33.61 per acre. In 1948 crops produced by these farmers on 2,100 acres were worth a total of $15,583, or a gross per acre average of $7.48. ●

RELEASES

New Maps Available

The Drafting Section of the Bureau of Reclamation has recently completed the following project maps: Central Valley project, California; Salt River project, Arizona; W. C. Austin project, Oklahoma; Gila project, Arizona; and Colorado-Big Thompson project, Colo-rado. These maps are available in both the small (10½ by 17 inches) and large (21 by 34 inches) sizes. The fol-lowing maps are only available at pres-ent in the small 10½ by 17 inch size: Riverton project, Wyoming; Hanover Unit, Big Horn Division, Missouri River Basin project, Wyoming; and Crow Creek Pump Unit, Three Forks Divi-sion, Missouri River Basin project, Montana. These maps are all in color, and requests should be sent to the nearest regional director (see directory on inside back cover of this issue), specifying the name and size of the maps desired. Single copies are free to those who have need of them in connection with their work or studies. ●

POSTSCRIPTS

That's a Joke, Son!

A preacher attended a golf tourna-ment. He dubbed shot after shot, he sliced, hooked, topped. Finally he yelled at the top of his voice, "Grand Coulee, Grand Coulee."

His caddie, surprised at this out-burst, asked the preacher what it meant.

"My son," replied the cleric, "That is the biggest dam in the world." ●

Don't Miss a Copy of Your ERA!

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NOTES FOR CONTRACTORS

Contracts Awarded During April 1951

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contrac amoun
DS-3293	Davis Dam, Ariz.-Nev	Apr. 27	Supervisory control and telemetering equipment for Knob, Blythe, Maricopa, and Phoenix substations, Parker and Davis power plants, and Phoenix dispatchers' office.	Control Corp., Minneapolis, Minn.	$44,
DS-3300	Columbia Basin, Wash	do	5 lots of equipment, 30 mobile radio transmitter-receiver assemblies, and 12 lots of alarm receiving equipment for Quincy, Ephrata, Adco, Moses Lake, and Winchester, Wash.	Radio Corp. of America, Camden, N. J.	42,
DC-3306	Colorado-Big Thompson, Colo.	Apr. 11	Construction of Flatiron power and pumping plant and afterbay dam, Estes Park-Foothills power aqueduct.	Winston Bros. Co., Monrovia, Calif.	2, 240,
DC-3307	Eklutna, Alaska	Apr. 9	Construction of 6 3-bedroom and 6 2-bedroom residences, 2 10-car garages, streets, and utilities for Eklutna government camp.	Denali Construction Co., Anchorage, Alaska.	389,
DS-3311	Davis Dam, Ariz.-Nev	Apr. 17	1 lot of equipment for selectively calling substations and power plants of region 3 power dispatching system.	Electrical Communications, San Francisco, Calif.	20,
DS-3312	Missouri River Basin, Wyo	Apr. 5	1 10,000-kilovolt-ampere autotransformer for Lovell substation, schedule 1.	Pennsylvania Transformer Co., Canonsburg, Pa.	41,
DS-3312	do	do	3 115,000-volt and 1 69,000-volt circuit breakers for Lovell substation, schedule 3.	Pacific Electric Manufacturing Corp., San Francisco, Calif.	85,
DS-3312	do	do	8 115,000-volt disconnecting switches for Lovell substation, schedule 4.	Schwager-Wood Corp., Portland, Oreg.	20,
DC-3315	Columbia Basin, Wash	Apr. 3	Construction of earthwork and structures for East Low Canal and Lind Coulee wasteway.	J. A. Terteling & Sons, Inc., Boise, Idaho	3, 490,
DC-3318	Missouri River Basin, S. Dak.	Apr. 2	Construction of 72 miles of Fort Randall-Winner 115-kilovolt transmission line.	Orlando Construction Co., and Louis Orlando, Coleman, Wis.	604,
DS-3319	Rio Grande, N. Mex	Apr. 5	1 5,000-kilovolt-ampere shunt reactor, 1 14,400-volt circuit breaker, and 2 15,000-volt disconnecting fuses for Albuquerque substation, schedules 1, 3, and 5.	General Electric Co., Denver, Colo.	26,
DC-3320	Cachuma, Calif	do	Construction of Lauro Dam	Clyde W. Wood & Sons, Inc., North Hollywood, Calif.	723,
DS-3321	Missouri River Basin, Nebr	do	3 42- by 30-foot radial gates and 3 counterweight frames for spillway at Trenton Dam.	Johnson Machine Works, Inc., Chariton, Iowa.	133,
DC-3327	Central Valley, Calif	Apr. 16	Construction of laterals 124.5E, 127.7E, and 130.4E and sublaterals, including reservoirs and pumping plants, unit 3, Southern San Joaquin municipal utility district, Friant-Kern Canal distribution system, schedule 2.	United Concrete Pipe Corp., Baldwin Park, Calif.	1, 671,
DC-3333	Gila, Ariz	Apr. 12	Construction of earthwork and canal lining for Wellton Canal	Morrison-Knudsen Co., Inc., Los Angeles, Calif.	973,
DC-3334	Columbia Basin, Wash	Apr. 26	Installation of heating and ventilating system for units R1 to R9, right powerhouse, and supplemental and miscellaneous heating and ventilating systems for left powerhouse, Grand Coulee power plant.	Dorrington Sheet Metal Works, Denver, Colo.	83,
DC-3336	do	do	Construction of State highway 10-A, grading and paving streets and parking areas, and construction of drain inlets, sidewalks, curbs, and retaining wall in town of Coulee Dam, Wash.	McAtee and Heathe, Spokane, Wash.	187,
DC-3338	Colorado-Big Thompson, Colo.	Apr. 12	Construction of 22 miles of Gore Junction-Muddy Pass 69-kilovolt transmission line.	Smith Hi-Line Co., Nashville, Tenn.	209,
DC-3343	do	Apr. 16	Construction of Willow Creek Dam	Peter Kiewit Sons' Co., Omaha, Nebr.	1, 294,
DS-3346	Hungry Horse, Mont	Apr. 9	Miscellaneous structural steel, including platform, stairs, and handrailings, for generator room at Hungry Horse power plant.	St. Joseph Structural Steel Co., St. Joseph, Mo.	23,
DC-3347	Columbia Basin, Wash	Apr. 25	Construction of earthwork and structures for Rocky Coulee drain wasteway, EL 29 B wasteway, DE 226 wasteway, and EL 20 wasteway No. 2, Rocky Coulee drain wasteway system, East Low Canal laterals.	Intermountain Plumbing Co., Inc., and Henry L. Horn, Moses Lake, Wash.	128,
DS-3353	Colorado-Big Thompson, Colo.	Apr. 20	Steel structures for 115-kilovolt switchyards for Flatiron power and pumping plant and Pole Hill power plant.	American Bridge Co., Denver, Colo.	29,
DS-3354	do	Apr. 27	1 25-ton overhead traveling crane for Willow Creek pumping plant.	Moffett Engineering Co., Albany, Calif.	14,
117C-96	Columbia Basin, Wash	Apr. 10	Construction of garages, warehouse and storehouse at O. & M. Headquarters, Quincy, Wash., schedule 1.	E. O. Johnson Co., Spokane, Wash.	56,
117C-96	do	Apr. 17	Construction of garages, warehouse and storehouse at O. & M. Headquarters, Othello, Wash., schedule 2.	W. J. Park & Sons, Yakima, Wash.	71,
117C-98	do	Apr. 6	Construction of fencing and protective structures, West Canal, station 351+72 to 2,044+50 and Winchester Wasteway, station 0+00 to 964+00.	Arnold B. Pontius, Spokane, Wash.	122,
100C-120	Hungry Horse, Mont	Apr. 11	Relocation of East Side forest service telephone line	McWaters and Bartlett, Boise, Idaho.	91,
300C-18	Boulder Canyon, Ariz.-Calif.-Nev.	Apr. 2	Construction of physical education and industrial arts buildings at Boulder City.	Lembke Construction Co., Las Vegas, Nev.	443,

Construction and Materials for Which Bids Will Be Requested by August 1951

Project	Description of work or material
Boise, Idaho	Construction of roads in Anderson Ranch Dam area.
Central Valley, Calif	Construction of Columbia and Mowry outdoor-type pumping plants and reaches of Columbia and Mowry Canals on the Delta-Mendota Canal distribution system, located 8 miles southeast of Firebaugh, Calif.
Do	6 propeller-type, 33.3 cubic feet per second capacity and 2 horizontal, centrifugal-type, 15 cubic feet per second capacity pumping units for pumping plants Nos. 1 and 2, Columbia Canal; and 2 propeller-type, 5 cubic feet per second capacity pumping units for pumping plant on Mowry Canal, Delta-Mendota Canal distribution system.
Central Valley, Calif	Motor-control switchgear, distribution switchboa and float switches for Southern San Joaquin muni pal utility district No. 3.
Do	Construction of 40- by 70-foot reinforced concrete minstration building at Tracy switchyard.
Do	Construction of 102- by 322-foot steel warehouse Folsom power plant.
Do	3 oil-pressure actuator-type 231,000-foot-pound capac governors for the 74,000-horsepower turbines at F som power plant.

Construction and Materials for Which Bids will be Requested by August 1951—Continued

Project	Description of work or material
rado-Big Thomp-n, Colo.	Construction of Rattlesnake Dam, a 105 foot high, off-stream, 400,000 cubic yards, earth-and-rock fill structure having a 10,400 cubic foot per second capacity spillway, 14 miles west of Loveland, Colo.
Do	Construction of 2,100 feet of concrete-lined Pole Hill Canal and 500 feet of concrete bench flume to carry a capacity of 550 cubic feet per second from outlet of Pole Hill tunnel to penstock inlet at Pole Hill power plant.
Do	1 76-inch butterfly valve for Flatiron power and pumping plant.
Do	Generator voltage bus and circuit breaker for Pole Hill power plant.
Do	Main control boards, supervisory control boards and supervisory and carrier equipment for Flatiron power and pumping plant and Pole Hill power plant.
Do	1 460-volt distribution board, 3 motor- and heating-control boards, 2 125-volt battery chargers, 2 500-kilovolt-ampere transformers, and 1 37½-kilovolt-ampere transformer for Pole Hill power plant.
Do	Motor control switchgear for Willow Creek pumping plant.
mbia Basin, Wash.	Furnishing and placing armor rock and riprap rock for slope protection of river channel downstream for Grand Coulee Dam.
Do	Construction of 292 cubic feet per second capacity, 10 unit Babcock pumping plant, a 23- by 136-foot concrete substructure with steel or concrete superstructure on lateral W35.9 of West Canal, 3 miles southwest of Quincy, Wash.
Do	10 centrifugal-type electric motor driven pumping units of 17 to 30 cubic-feet-per-second capacities for Babcock pumping plant.
Do	Construction of 17 miles of laterals, 36 miles of sub-laterals, 14 miles of drain wasteways for lateral area W–6A on West Canal.
Do	Construction of 15.5 miles of unlined Potholes East Canal, 1,800-cubic-feet-per-second capacity, and 5 miles of unlined Ringold wasteway, 1,800 cubic-feet-per-second capacity, 6 miles southeast of Othello, Wash.
Do	Construction of Royal watermaster headquarters and temporary construction camp about 7 miles north of Corfu, Wash.
Do	Constructing streets, walks, and mechanical and electrical utilities at Eltopia, Wash.
Do	Completion of electrical installations in industrial area at Grand Coulee Dam; completion of machine shop and warehouses A and B; fencing for feeder canal and industrial area; construction of retaining wall for right powerhouse parking area; enclosure of end of assembly building and drainage facilities at vista sites; and comfort station at Greene Athletic field.
Do	Furnishing and installing lawn sprinkler systems and landscaping at O. & M. sites at Adco, Ephrata, Mesa, Moses Lake, Warden, and Winchester, Wash.
Do	Erection of 80-foot span bridge, furnishing and constructing 69-foot span timber county road bridge superstructure on Rocky Coulee wasteway, and gravel surfacing for 1,700 feet of county road.
Davis Dam, Ariz.-Nev.	Fabricated galvanized structural steel for transformer circuit structures for Davis 69-kilovolt switchyard and installation.
Do	Construction of paint shop, washing and greasing building, vehicle repair shop, service station, and storage sheds.
Do	Erection of steel structures and installation of additional electrical equipment for Tucson substation.
Do	Erection of steel structures and installation of electrical equipment for 20,000-kilovolt-ampere Cochise substation.
Do	Main control board for 230-, 115-, and 13.8-kilovolt circuits for Prescott substation.
Deschutes, Oreg.	Clearing Wickiup reservoir area near Bend, Oreg.
Eklutna, Alaska	2 vertical-shaft Francis-type hydraulic turbines, each 24,000 horsepower at 807-foot head, for Eklutna power plant.
Klamath, Oreg.-Calif.	Construction of laterals and drains for N Canal area second extension on the Tule Lake sump, including raising canal banks and removing existing pumping plant outlet structure, and construction of new outlet structure.
Do	Improvement of a channel for Lost River in Upper Langell Valley, about 20 miles east of Klamath Falls, Oreg.
Kendrick, Wyo.	Construction of Bairoll substation, including structural steel and installing electrical equipment.
Do	2 160-inch turbine butterfly valves for Alcova power plant.
Missouri River Basin, Mont.	1 9.04- by 9.04-foot fixed wheel gate lifting frame, 1 gate engagement indicator, and 4 gate slot closures for Canyon Ferry Dam.
Do	1 main control board, 1 annunciator relay cabinet, 1 1,500-kilovolt-ampere unit substation, 1 460-volt board, and 2 5-kilowatt battery chargers for Canyon Ferry power plant.
Missouri River Basin, Nebr.	Construction of Franklin south side pumping plant, 5 miles of unlined Franklin south side canal, 5 miles of laterals, and 2.8 miles of drains near Franklin, Nebr.
Missouri River Basin, S. Dak.	Construction of 2,000-kilovolt-ampere Bonesteel substation.
Do	Construction of 6,000-kilovolt-ampere Winner substation.
Do	Construction of 3,750-kilovolt-ampere Gregory substation.
Do	First stage construction of 10,000-kilovolt-ampere Woonsocket substation.
Missouri River Basin, Wyo.	Construction of 6,000-kilovolt-ampere Sinclair substation.
Provo River, Utah	Placing 3,000 feet of buried asphalt membrane lining in Weber-Provo diversion canal, located northeast of Kamas, Utah.
Rio Grande, N. Mex.	Construction of 20 miles of Rio Grande River drainage and conveyance channel and levee above Elephant Butte Reservoir.
Yakima, Wash.	Construction of 2 miles of drainage way consisting of earth ditch and concrete pipe with appurtenant reinforced concrete structures near Grandview, Wash.

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Oscar L. Chapman, Secretary
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Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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FEATURE ARTICLES

SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1.50 a year for persons residing in the United States and Canada; $2 a year for foreign subscriptions; special rate of $1 a year for members of water users' associations, and Bureau of Reclamation employees.

OUR FRONT COVER

FREEDOM—symbolized by the Nation's famous Liberty Bell—is the heritage of all American children. Although they are too young to understand, Billye Gayle McCloud, left, and Kathy Criswell, children of Bureau of Reclamation employees at the Hungry Horse project in Montana, are tolling the keynote on which this Nation was founded—"the right to live under a free and democratic government "of the people, by the people, and for the people." *Photograph by A. E. McCloud, Hungry Horse project photographer, Region 1.*

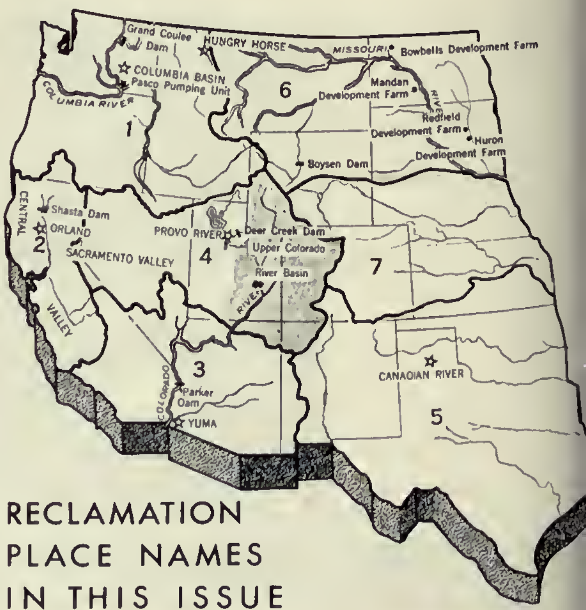
30 YEARS AGO IN THE ERA

Results of Irrigation by the Reclamation Servic

In the business world any undertaking that cannot m a profit will almost certainly show a loss, and this is rule under which the Secretary of the Interior must minister these numerous large projects if we cons dollars and cents in the reclamation fund alone. In administration of the reclamation law for 20 years and investment of upward of $120,000,000 from the reclama fund, it is now estimated that about $5,000,000 or less 5 percent, are chargeable to the several items sugge above for which there is no return in sight.

In a broader sense, against this loss to the fund ma set down the new wealth exceeding a half billion do and the large annual crop values that have resulted f effort based on the investment of the reclamation f

(From p. 302, July 1921 issue of the Reclamation Rec predecessor to the Reclamation Era.)



RECLAMATION PLACE NAMES IN THIS ISSUE

RISING ABOVE ITSELF—Arrow points to the biggest pumping plant in the world which began lifting the Columbia River above itself, back into its Ice Age Channels on June 14, 1951. Across the Nation, in Washington, D. C., Secretary of the Interior Oscar L. Chapman gave the signal for the pumps to start operating. On the scene in the State of Washington was Commissioner of Reclamation Michael W. Straus, proud of the engineers who had accomplished the unprecedented construction feat, scheduled for May (see "The Big Lift" on p. 86, May 1951 *Reclamation Era*). District Manager of the Columbia Basin project H. A. Parker reports that major structures to irrigate the first 87,000 acres of the project are on schedule. The map, looking south, shows the flow of water from Grand Coulee Dam, at bottom, by gravity to the project lands which begin almost 60 miles south. Ultimately 1,029,000 acres will be irrigated, providing vitally needed agricultural products for civilians as well as our military forces. Drawing made by Russ DuCette, *Region 1*.

Radioactive Fertilizers

ATOMIC SCIENCE HELPS SOLVE SOIL PROBLEMS

AGRICULTURAL ATOMS—Weighing in a shipment of radioactive phosphate at the Plant Industry Station at Beltsville, Md., above. At right, manufacturing "tagged" superphosphate fertilizer. Note that great care is being used to protect the operators from harmful radiations. ***Photos by W. J. Mead, Bureau of Plant Industry, Soils and Agricultural Engineering, U. S. Department of Agriculture.***

by L. B. NELSON, Soil Scientist, Division of Soil Management and Irrigation, Bureau of Plant Industry, Soils, and Agricultural Engineering, United States Department of Agriculture, Colorado A. & M. College, Fort Collins, Colo.

How much fertilizer phosphorus do crops use? What is the best kind of phosphate to use on different soils and different crops?

By means of "tracers," radioactive materials furnished by the United States Atomic Energy Commission are furnishing answers to these and many other questions important to agriculture.

Phosphorus, which is essential to the life of plants and animals, has been activated and used as a "tracer" in phosphate fertilizers, which contribute so much toward successful farming. Here in the West, for example, we use over a million tons of fertilizer each year—much of it containing phosphate and most of it going on irrigated lands. Even a small improvement in the use of phosphate means a huge saving in dollars and cents.

The "Tracer" Idea

The idea of tracers is simple. If you mix 1,000 white marbles with a basketful of white marbles, pull out a sample and try to find out the proportion of the original 1,000 to those already in the basket—you cannot do it. But if you "tag" the original 1,000 with 100 black marbles, then pull out your sample and count the black marbles, you know that each black marble is equal to 10 of the original 1,000 and you can calculate easily the proportion of added marbles to the total. Most Westerners are familiar with this; it is the old idea of "tagging" a band of sheep with blacks.

The procedure with radioactive tracers follows closely this same principle. Suppose you want to find out the amount of phosphorus in a crop coming from an application of phosphate, or the amount coming from the soil. First, a phosphorus compound is placed in an atomic pile at Oak Ridge by the Atomic Energy Commission and bombarded with neutrons until the phosphorus becomes active. Then it is shipped to the Plant Industry Station of the Bureau of Plant Industry, Soils, and Agricultural Engineering at Beltsville, Md. There, in a special manufacturing plant, the active phosphate is incorporated uniformly with the phosphorus in phosphate fertilizer—i. e., the phosphate rtilizer is "tagged" with radiophosphorus. The agged" fertilizer is shipped to the field and apied on small plots. After the crops feed on the rtilizer, the proportion of fertilizer phosphorus soil phosphorus taken up by the plant is obined by determining the total amount of phoshorus in the plant by chemical analysis, and by unting the tagged phosphorus.

The phosphorus coming from the fertilizer is sy to determine because one of its radioactive osphorus atoms decomposes every now and then nd gives off a radiation. The radiations are unted by a delicate instrument commonly known a Geiger Counter. Since one-half of the radiotive phosphorus is destroyed every two weeks, e tagging is good for only about four months.

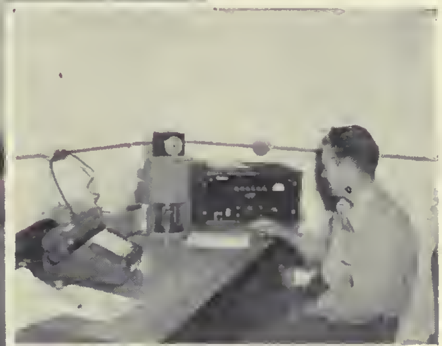
Radiophosphorus Studies in the West

Research with phosphorus-tagged fertilizers has en going on in the West since 1948. The work a joint undertaking between the State experient stations, the Bureau of Plant Industry, Soils, nd Agricultural Engineering of the United ates Department of Agriculture, and the Atomic nergy Commission. So far work has been conducted on irrigated lands in Colorado, Arizona, Idaho, Oregon, Washington, and Utah. This year, additional new work is being undertaken in Montana, North Dakota, South Dakota, Nebraska, Kansas, and California. The work under irrigation in North Dakota is being done in cooperation with the Bureau of Reclamation on the Bowbells and Mandan Development Farms, and in South Dakota on the Redfield and Huron Development Farms.

What the Results Are Indicating

Let us look at some of the findings here in the West. First, you may be surprised to know that in any one season crops actually use only a small amount of the fertilizer phosphorus applied. This seldom exceeds 12 to 15 percent, even on low-phosphorus soils. On the other hand, the more phosphorus there is available in the soil, the more soil phosphorus in the plant.

There are many different kinds of phosphate fertilizers. Which are the best for western soils? The studies have shown that superphosphate, ammonium phosphate, and phosphoric acid usually are the best. Calcium metaphosphate supplied less phosphorus to the crops than superphosphate in the early stages of growth, but about the same amounts thereafter. The phosphates of low solubility, such as dicalcium phosphate and tricalcium phosphate, are of less value on western soils, particularly the first year of application.



POURING IT ON—At extreme left, radioactive fertilizers, shipped to the field in mason jars, are emptied into the belt-delivery hopper of the distributor planter through a lead adaptor. *Photo by Colorado A. & M. College.* At immediate left, Dr. Sterling Olsen at Fort Collins, Colo., measures the radioactivity of plants grown on soils to which radioactive phosphate has been added. The plant material is placed under a Geiger tube housed in the lead shield.

How should phosphate fertilizer be applied to the soil? Results show that plants usually get the most out of fertilizers during the early stages of growth, if you apply the phosphate close to the seed. Later in the season, the most effective

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WATER BUFFALO clearing weeds in major drains of Pontine marshes (upper left). Street scene San Giovani in Fiori, a town in the Calabria region of Southern Italy (at right), during a visit the ECA Reclamation Mission. *Left photo by Bruni. Photographer for other photo unknow*

Reclamation under the Marshall Plan in Italy

by W. E. CORFITZEN, Reclamation Specialist, Economic Cooperation Administration, Rome, Italy

Part One—HOW THE PROGRAM BEGAN

On April 3, 1948, Congress enacted the Economic Cooperation Act of 1948 (Public Law 472), carrying into law the principles of European economic recovery enunciated by General George Marshall in his famous address at Harvard University on July 5, 1947. Thus was created the Economic Cooperation Administration (ECA) which has been popularly known as "the Marshall Plan." It is also often referred to as the European Recovery Program (ERP).

As a result of this legislation the United States made available to Italy about $600,000,000 for the first year of operation (1948–49). A novel plan was devised for rapidly improving the Italian national economy. It will be recalled that following the war all European countries found themselves with a scarcity of almost every conceivable article. Black markets flourished. Luxury items commanded the highest prices, and merchants naturally endeavored to import those items on which they could make the greatest profits. In view of the extreme shortage of foreign exchange and the urgent need to improve the basic econom the Marshall Plan operated as follows:

Merchants who wanted to import commoditi made application to the Italian Government for a import license and if, after examination, the Go ernment was satisfied that the commodity w needed to improve the national economy, a licen was granted. The merchant paid the price of t commodity in lire to the Italian Governme which deposited the money in the National Tre sury to what was known as the "Counterpart Li Fund." With merchants importing food, ste machinery, spare parts, and all the other ma items needed to restore basic economy, a lar counterpart fund was built up. To spend th sum for the rapid improvement of the nation economy, the Italian Government prepared budget with the advice and assistance of the EC Mission. Seventy billion lire was allocated Agriculture—about $117,000,000. Of this amou $70,000,000 was allocated for reclamation project This program envisaged a total expenditure f reclamation projects of about $300,000,000 duri the period of ECA assistance (until July 1, 1952

About the author—Ed Corfitzen began his career as a civil engineer in the hydraulic laboratory of the Bureau of Reclamation in Denver in 1933, specializing in sedimentation and related engineering problems. While in Denver he enrolled in and graduated from the University of Denver Law School and was admitted to the Colorado Bar in 1940. Combining engineering and law, he was transferred to administrative engineering duties on the Commissioner's staff in Washington where he was responsible for coordinating activities on the Water Conservation and Utilization Program. During the war he organized the Foreign Activities Section of the Bureau to more efficiently assist the State, War, and Agriculture Departments and various embassies when these agencies sought specific aid on reclamation. In 1947 he was loaned by the Bureau to the State Department to serve as Reclamation Specialist on the American Mission for Aid to Greece. Upon completion of this assignment, his services were requested by ECA. While his primary responsibility is the Italian Reclamation program, he also serves on the staff of the Special Representative in Paris as Reclamation Consultant to all other countries in the ECA orbit having reclamation projects.

Italy is essentially a hilly and mountainous ountry, having a total area of 30,906,000 hectares, or 76,337,820 acres, 2.47 hectares equalling 1 acre) ll but 2,367,000 of which are productive and of hich 12,753,000 hectares (31,499,910 acres) are rable.

Water control and the construction of hydraulic orks are old sciences in Italy, having started efore the Roman Era. In the province of Lomardy there are important irrigation projects hich began about 1100. By the end of 1905 the tal area irrigated was estimated at 1,500,000 ectares (3,750,000 acres). By 1939 many projects ad been constructed, utilizing surface and underround water supplies, and the area was increased 2,100,000 hectares (5,250,000 acres). During is same period many swamps, such as the Pontine larshes south of Rome, were reclaimed by the nstallation of large pumping plants, and plans ere accordingly made for the extension of the eclamation program.

During the war many of these projects suffered amages, either actual war damage or deterioraion caused by lack of maintenance. The end of he war found a number of projects with plans, hich had been prepared prior to the war, and eady for expansion. But reorientation was reuired, especially in view of the lack of national unds, and social pressures and pressing requireents for additional food. Consequently, the Ministry of Agriculture, the Ministry of Public Works, and the National Land Reclamation and rrigation Association undertook a study of the roblems in the light of the then pressing and uture requirements. It was decided that three rincipal problems existed:

1. Readjustment of water supplies and changes n obsolete irrigation systems.

2. Coordination of irrigation and power projects.

3. Coordination of planning activities and extension of irrigation systems.

This was the status of the program when the ECA Mission began operations in Italy in the summer of 1948. Of the 18 countries participating in the Marshall Plan, the Italian reclamation program was so far advanced that it was decided to send a reclamation specialist to Italy to concentrate on that program until programs for other countries could be presented and considered at a later date.

Preliminary examination revealed that the reclamation program in Italy involved considerably more than do reclamation programs in the United States. In the United States, generally, flood control, drainage, irrigation and incidental power developments are included, while the Italian program includes not only these aspects but also many others which would be required to develop

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STARK EVIDENCE of parched acres is the farm above, abandoned for lack of water. ACRES OF ALMONDS at right were made possible by irrigation. *Top photo by W. H. Colby, right photo by Ben Gloha, both of Region 2.*

Canals for Sacramento Valley

A DEMONSTRATION OF AMERICAN DEMOCRACY AT WORK

by DONALD M. SMITH, Secretary, Sacramento Valley Irrigation Committee, Red Bluff, Calif.

MORE THAN GOLD HAS BEEN DISCOVERED IN CALI-FORNIA.

We, the people of four Sacramento Valle counties, discovered the secret of success.

We discovered how to keep our sights levele on our objective, and work together for the commo good. In doing this, we learned a lesson in democ racy.

We farmers and agricultural leaders fro Tehama, Glenn, Colusa, and Butte Counties bega to be alarmed by dropping water tables. W knew what dry years meant. We knew what w needed and wanted—water.

We also knew that when the Central Valle project was authorized in 1935, it provided fo canals on the east and west side of the Sacrament River. Of course, at that time, we did not thin we would need them for about a quarter of a cen tury. But World War II, a boom in population, demand for increased agricultural productio and the subsequent drain on water supplie brought us smack up against the future. Th

Sacramento Valley canals were no longer a dim and distant plan, but a sharp and present need.

Obstructionists claimed it was impossible. Too many warring factions, too much red tape. Nevertheless, we got in touch with our elected representatives to the Congress of the United States, and with public officials who were in charge of the Central Valley project in our area. And in November 1948 we held a regular Town Meeting (or Valley meeting, as it turned out to be) at the Hotel Maywood in Corning, Calif. Men of opposite political beliefs, of varied interests, of different creeds, and many who were total strangers to one another talked the situation over with Representative Clair Engle and people from the Bureau of Reclamation. Out of that meeting came the Sacramento Valley Irrigation Committee, and a determination to put "first things first" and get a bill passed which would authorize construction of Sacramento River Canals as a part of the Central Valley project.

A little less than 2 years later, we met at the same place, in the same room, to celebrate the passage of Public Law 839 by the Eighty-first Congress, authorizing federally constructed works to irrigate nearly a quarter million acres in the rich, but dry, Sacramento Valley.

During those 2 years none of us were loafing or letting the other fellow do the job.

We stated our case to the Governor of California. He gave the project his unqualified and emphatic endorsement. So did his State Water Committee.

Twice, members of the Sacramento Valley Irrigation Committee traveled across the Nation to present their problem before Congress. What Congress learned from these farmers paved the way for unanimous consent of both Houses for approval of Public Law 839.

Sam Decker, member of the committee's Butte County unit, told the Senate that when he ran his pumps, his neighbors have no water, and have to irrigate at night while he pumps during the day to make full use of the available water. He convinced the committee members that the canals will make water cheaper and give the farmers the security of crops every season. Marshall Lane, chairman of the Glenn County board of supervisors, who has a diversified farm in the Bureau of Reclamation's Orland project, and George Otterson, Glenn County supervisor and a stockman for the past 30 years, both testified before members of the Senate, stressing the plight of Sacramento Valley's dairy and livestock industry, and urging action on the canals.

Max Vann of Williams, Calif., was the committee's chairman. For the past 30 years he has

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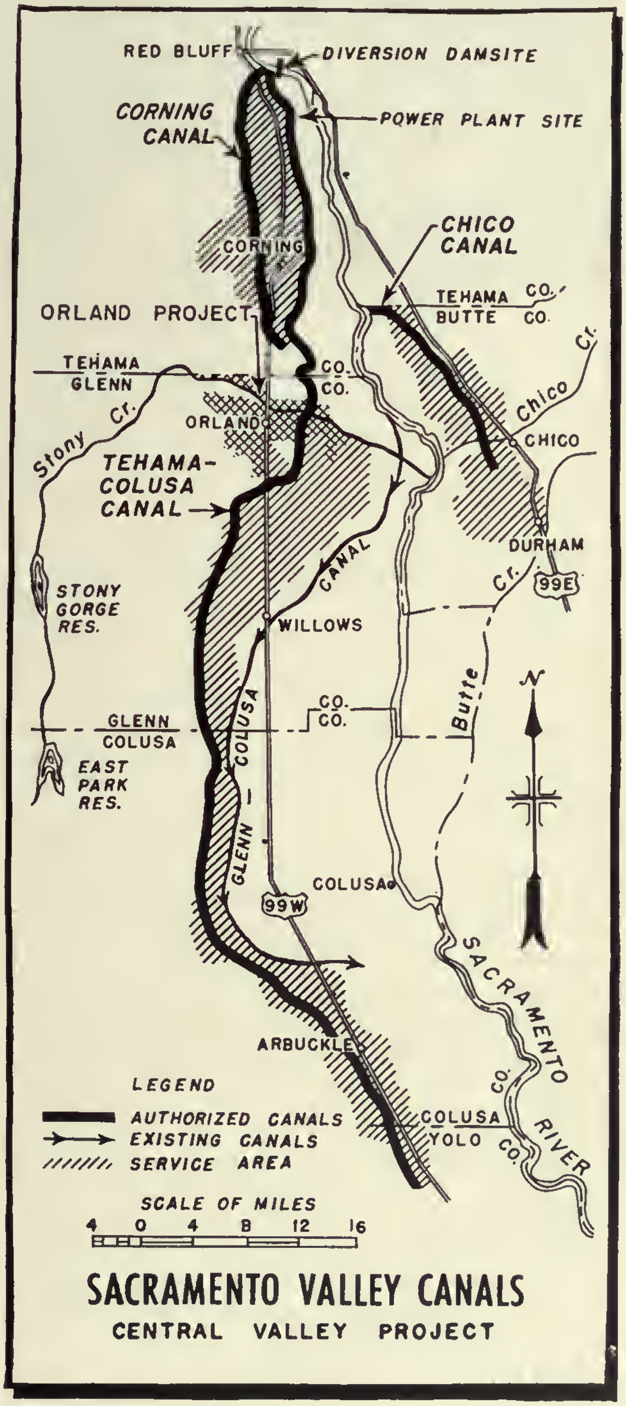

ALMOST A QUARTER OF A MILLION ACRES of rich but dry land in California's Sacramento Valley can be watered by the canals authorized by Public Law 839 as shown in map at right.

GIANT BLADE AT BOYSEN

THE SNOUT—This swordfish-like blade attached to a bulldozer is felling trees faster than the mythical Paul Bunyan. ***All photos in this article by T. R. Broderick, Region 6.***

by R. L. BRANAM, Billings, Mont., Region 6 Headquarters

A MACHINE WHICH BETTERS THE WOODCUTTING PROWESS of the mythical Paul Bunyan is in operation in the clearing of trees in the reservoir area of the Bureau of Reclamation's Boysen Dam, now under construction on the Bighorn River about 20 miles south of Thermopolis, Wyo.

Trees up to 24 inches in diameter fall with a single swipe of the 6-foot-long V-shaped saw blade which is attached to a bulldozer challenging Bunyan's "blue ox" for sheer strength.

The spectacular cutting job is an innovation introduced into reservoir clearing operations in this area by the Mid-States Construction Company of Chisholm, Minn., and which has been adopted by six other contractors engaged in reservoir clearing operations for the Bureau of Reclamation in Wyoming.

With the use of the mammoth saw, which has teeth on each side, a single dozer can fell as many trees as could be cut by five chain saws and crews. Because of the resultant saving of time, it is expected that the reservoir area will be cleared of all growth by July 1, 1951, beating the originally scheduled time by more than 6 months.

The operation is extremely simple. The dozer operator guides the saw so that it strikes the tree near the point of the cutting edge and then forces the saw through the trunk, cutting, with a single pass, cottonwood trees with a diameter up to 24 inches. A single machine can fell up to 5 acres of dense timber in 8 hours. In areas with less cover, 10 acres can be cut in an 8-hour shift.

In Boysen Reservoir, the contractors also have adapted a rake arrangement to the dozer blade. The heavy tines extend below the blade about 8 inches and gather brush and other growth as the dozer blade collects the cut trees and uproots the smaller trees not felled with the saw blade.

The saw blade, with which it is possible to cut the trees at ground level, has several variations at Boysen, with the six contractors engaged in clearing Boysen Reservoir using slightly different blades and teeth arrangements. Some of the blades are finely cut and kept sharp; others work with a tearing action and do not require sharpening.

The six contracting firms presently engaged in clearing operations at Boysen are Asbell Bros. of

BURNING DEBRIS after all usable timber has been salvaged, at left. Timber is no obstacle to this low-cutting, bulldozer mounted blade above, which clears 5 acres of dense timber in 8 hours.

Riverton, Wyo.; Lichty Construction Co. and Brasel & Whitehead of Riverton; A. M. Conrad of Big Piney, Wyo.; Watkins & Pennington of Fort Collins, Colo.; Linquist, Olson & Co. of Cambridge, Minn.; and Mid-States Construction Co. C. L. Hubner Co. of Denver recently completed a clearing contract. The total area to be cleared under the seven contracts amounts to 12,722 acres, of which 3,610 acres were classified as heavy timber.

A saw with a single blade has been adapted for use in cutting pine and cottonwood trees in the clearing of the reservoir area for the Bureau's Keyhole Dam on the Belle Fourche River near Moorcroft, Wyo. The blade in use here by the Lamb Construction Co. of Lusk, Wyo., is shorter and more adaptable to the terrain and cover at the reservoir site. Keyhole Reservoir will provide for the control of floods and for additional irrigation water for the Belle Fourche project in western South Dakota.

The Bureau will salvage from Boysen Reservoir 20,000 trees, 4 to 12 inches in diameter, to be used in its erosion-control program on Five Mile Creek which extends west from the upper end of the reservoir area. Because they have no commercial value, the rest of the cottonwoods will be burned with the brush. All heavy cover at the shore of the reservoir and all loose material from the middle of the reservoir area must be removed in order that the flotsam will not interfere with the operation of the dam and power plant or create hazards for the recreational use of the reservoir.

The control and conservation of the flows of the Bighorn River by Boysen Dam will indirectly make possible the eventual irrigation development of about 120,000 acres of land. The 72,000,000 kilowatt-hours of electrical energy to be generated annually at the 15,000-kilowatt Boysen Power Plant will help to relieve a critical power shortage in the Big Horn Basin. The development, which is a part of the Missouri River Basin project, also will provide for the control of floods and silt and the expansion of recreational possibilities and fish and wildlife habitat.

The lake formed by the 220-foot-high earthfill dam will cover an area of 19,660 acres and will have a normal operating pool of 820,000 acre-feet of water. Additional storage of 673,000 acre-feet will be provided for control of floods. Work on the 1,000-foot-long dam started in the Fall of 1947 and is scheduled to be completed this year. The power plant is expected to be in operation next spring.

THE END

RECLAMATION UNDER MARSHALL PLAN

(Continued from page 137)

land from a raw state to a fully going concern. Such features are highways, farm centers (including churches, schools, post and telegraph offices, police stations, and other civil services), farm buildings, transmission lines, etc. Another essential difference in the two programs is that in the United States, water user's organizations, in general, must repay to the Federal Government the cost of reclamation works over a 40-year period without interest. The Italian program is based upon the premise that reclamation works are a national benefit and that the costs will be repaid

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the Government through taxes on the lands developed. Under the Italian law the Government contributes 87.5 percent of the cost of reclamation features to southern projects and 75 percent to northern projects, with local interests contributing 12.5 and 25 percent respectively. In the case of major features, such as construction of dams or river regulation, the Government pays the entire cost.

In view of these essential differences it was decided that every project would be carefully screened in order that the Mission could be assured that any given project would definitely contribute to the agricultural economy of Italy and to be certain that counterpart funds were being used only for projects which would compare favorably with reclamation projects selected for development in the United States. With this in mind a general criterion was established that only projects would be considered which would guarantee a maximum production of food in a minimum amount of time with a minimum amount of money. The Mission established a firm policy that no projects would be considered unless they were transmitted to the Mission by the Ministry of Agriculture. This made it possible to relieve the Mission immediately of the burden of discussing projects with pressure groups and individuals who had private interests or an "axe to grind," and made it possible for the Mission to devote its time exclusively to the examination of projects which had the approval and support of the Italian Government.

(See September 1951 issue for The Working Plan, part two in a three-part series.

KEEP YOUR EYE ON PELLETED SEED

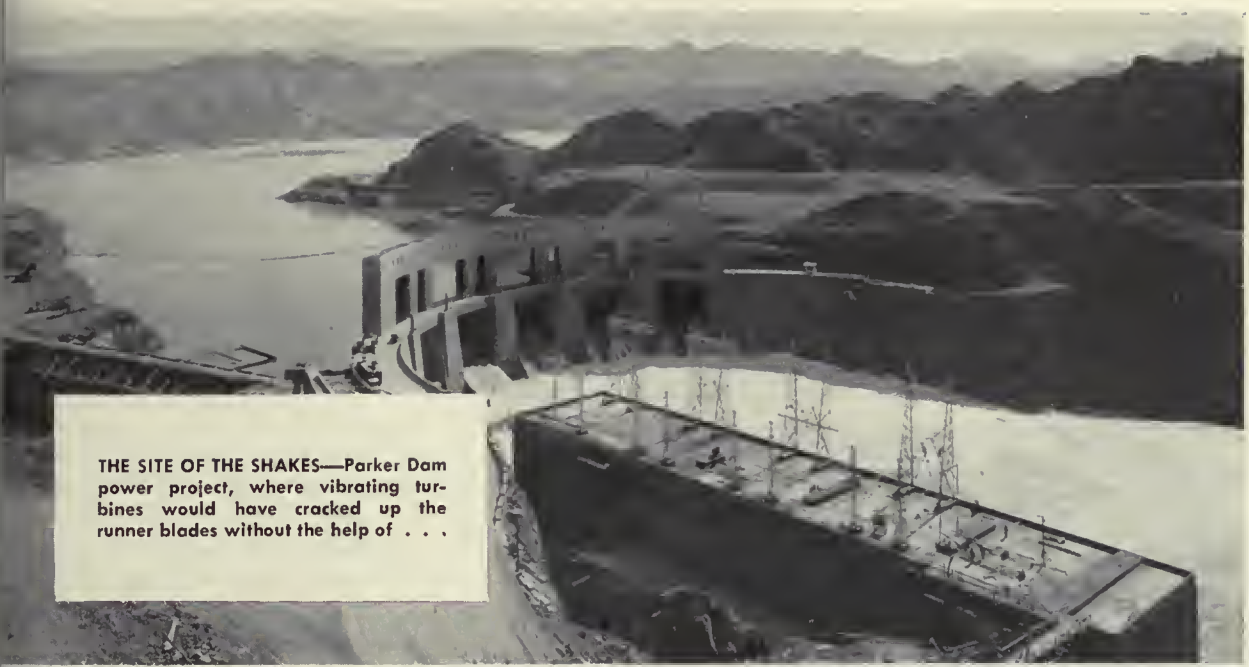
Four or five planting seasons ago, THE FURROW published a story on what was then an innovation in farming—the use of pelleted seed. The practice involves giving individual seeds, particularly the tiny, hard-to-handle ones, a coating to make them smooth, uniform in size and easier to handle. The idea promises now to catch on permanently, for at garden-planting time this year, the pellets could be purchased from many seed outlets.

Among other advantages of pelleting are the savings in seed used, since the pellets can be spaced as plants are wanted in garden or field. This saves on thinning labor and costs. The inert, nontoxic coating material also is given a mite each of chemical fertilizer, fungicides, and synthetic hormones to speed growth.

Shown below, a machine that coats seed looks simple, on the outside, at least. It revolves like a cement mixer, agitating the seeds and spraying them with the mix. When processed, pelleted seeds resemble buckshot. Being smooth and uniform, they will feed through a drill more accurately than will unpelleted seeds, samples of which are also shown for comparison.

Commercial growers of such crops as tomatoes, carrots, and sugar beets use pelleted seed on a large scale. Looking ahead, it's something for all farmers and gardeners to keep an eye on. (Reprinted through the courtesy of Deere and Company, publishers of THE FURROW, from the August–September 1950 issue.)

ROUGH DIAMOND, garden variety, receives automatic polishing, below. At right, pelleted and unpelleted seed. *Photos courtesy of Deere and Company, publishers of The Furrow.*



THE SITE OF THE SHAKES—Parker Dam power project, where vibrating turbines would have cracked up the runner blades without the help of . . .

Photo taken by Phil Blew in 1942.

PARKER TROUBLE-SHOOTERS

y D. L. GOODMAN, Engineer, Branch of Design and Construction, Denver, Colorado

To Reclamation engineers it was all in the ay's work, but to those unfamiliar with activities onnected with the Bureau's power plants it was dramatic story of 5 years of patience, perseverance and painstaking engineering which finally aid off.

It is a story of machines and men. The machines are the huge 60-ton turbines at the Parker Dam power project on the California-Arizona order. The men are a small group of trouble-hooting engineers who solved the stubborn and omplex problem of vibrating turbines which hreatened to shake themselves out of business.

The story began in 1946, 3 years after the four 0,000-horsepower (30,000-kilowatt) turbines had een completely installed in the Parker plant. By hat time these spinning iron giants were vibrating so badly that the turbine runner blades were eginning to crack. In fact, if you had stood in he turbine pit at that time, you would have heard he syncopated beat of "arumph, arrumph, arrumph" caused by 180 tons of water slamming gainst the blades every second. Under this teady vibrating action, the cracks gradually grew, spreading out on each of the four turbines' blades.

Unit No. 1, installed in December 1942, was the hardest hit. During the first major overhaul in the spring of 1946, when Bureau engineers investigated the extent of the damage, they found 14 out of the 15 runner blades to be seriously cracked near the top or crown of the turbine runner. In addition, the high velocity flow of water at subatmospheric pressures had pitted out critical areas of metal.

The first repairs made on Unit No. 1 and on the other three units at that time consisted of chipping out the cracked and pitted areas and partially filling the cavities with a soft steel welding material. The remainder of the pitted areas was then filled with stainless-steel rod, a metal highly resistive to the pitting action of the flowing water, and ground to the proper contour. However, these alterations did not eliminate the cause of the cracks, and within a short time they appeared again.

After this initial repair work, the engineers tried other techniques to correct the destructive shimmy. First they sharpened the leading edges of the runner blades by welding a ½-inch-square bar on the edge for the full length of the blade.

TROUBLE SHOOTERS AT WORK, directly below, fastening specialized instruments to runner blades. Farther down, the instruments "tuned in" on the Unit 1 runner (these two photos by Don H. Edwords). At center, below, one of the big 60-ton turbine runners being lifted from o freight car in October 1941 *(photo by Bertrom S. Mock)*. At extreme right, below, an idea of the extent of the cracking caused by vibration damage to one of the blades on Unit 1 turbine runner *(photo by George O. Bonowit)*. Inset, artist Morie L. Lang's sketch of a Parker Power Plant turbine runner.

However, no significant reduction in the vibration was apparent.

Next they tried inserting round metal rods between adjacent blades on all four runners to reduce the vibration. But the rods merely transferred the force of the vibration and cracks grew where none had been before. Metal rods similarly placed on the trailing edge of the runner blades were equally ineffective.

The engineers then inserted 1-inch pipes, perforated with ⅛-inch holes, into various parts of the runners, and pumped compressed air into strategic areas, hoping that the air would act as a cushion for the vibration. Although this cut down some of the noise, the runners continued to crack at a serious rate.

Later efforts included trimming the edges of the wicket gates (shutter-like mechanisms resembling venetian blinds which control the flow of water into the runners) and finally, as an emergency measure, completely rewelding the broken runners on the theory that the repair material would be considerably stronger than the original metal. Again, these efforts were of no avail, as the runners cracked in the same location about as rapidly as before.

To minimize the cracking, the powerhouse operators, in August 1948, were forced to restrict the flow of water to eight-tenths of the full gate open-

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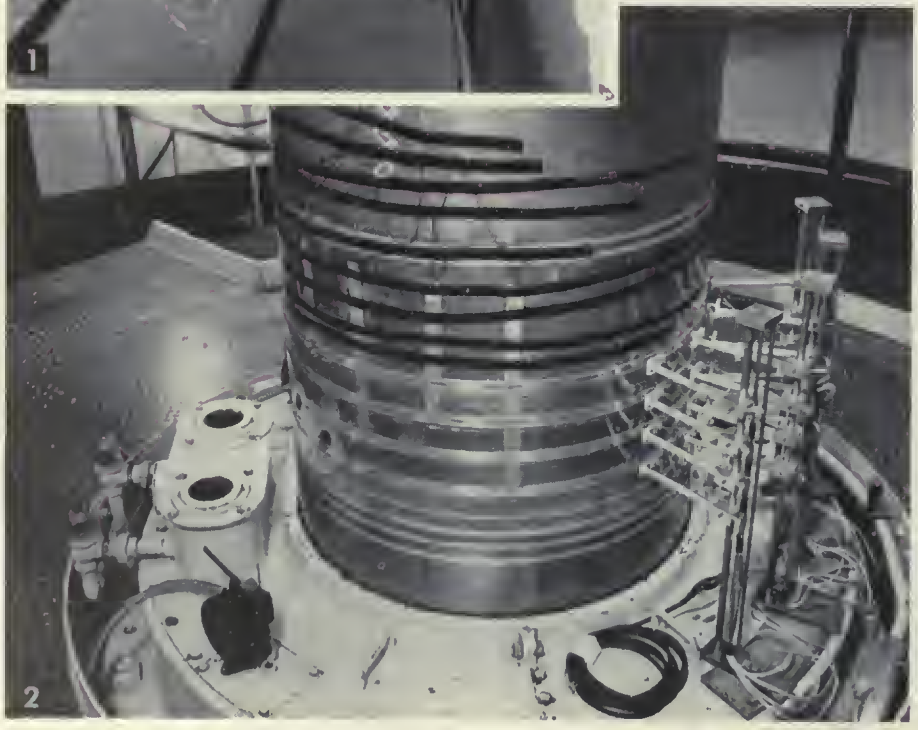

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ng. This limited gate opening condition existed ntil January of this year.

In the Spring of 1950 a small group of trouble-hooters arrived at Parker prepared to conduct xhaustive tests on the turbine's anatomy and erret out the cause of the behavior of the turbine unners.

Armed with a variety of highly sensitive instru-ments, including such gadgets as oscillographs and pecial cells which measure pressure, strain, and cceleration, they descended into the bowels of the Unit No. 1 runner on the morning of Friday, April 14. Working against time, while the unit as shut down, these specialists rigged up an ex-ensive network of the test apparatus throughout he turbine runner and adjacent areas. Every onceivable segment of the runner and related ater passages was thus "tuned in" so that no rea would escape attention under the vigilant iagnosticians' probing of the badly shaken runner ody.

By 11:30 Sunday night, 50 hours later, the ex-austed trouble-shooters climbed out of the draft ube (below the runner), their instruments tied into a collector placed on the turbine shaft in the pit above the runner. The turbine was then started up as soon as the water again flowed in the unit, and readings were carefully taken from all the instruments in operation below.

The data thus obtained showed conclusively that the only possible source of the trouble existed at the trailing edge (inside edge) of the runner blades. From this conclusive evidence which pin-pointed the source of the vibration, the trouble-shooters recommended that the trailing edges be sharpened, reducing the weight of each blade by 20 pounds. By thus modifying the trailing edge, the water could follow a smoother path in its descent through the runner—helping to minimize the vibration.

Alteration of the blades was sound from a theo-retical viewpoint. By smoothing the approach surfaces and squaring the corners of the trailing edges, alternating pressures set up by zigzag eddies of water, known technically as vortex trails, were eliminated. Canceling out the eddies re-moved the forces which produced pressure changes which in turn induced vibration.

Following the engineers' recommendation for altering the blade edges, Unit No. 1 was shut down on October 25 last year, and round-the-clock work shifts began grinding the trailing edges along the entire lengths of the 15 blades of the runner. The work was completed by the morning of November 5. Modification of the remaining three units was scheduled to follow.

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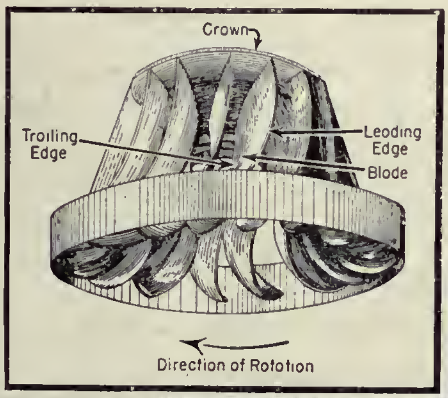


MAIN ARTERY for Irrigation Block 40 in Grant County, Washington, is East Low Canal, above. *Photo by H. E. Foss, Region 1.*

Land of HEART'S DESIRE

by CLINT AMO, Land Settlement Specialist, Columbia Basin Project, Washington, Region 1 (Headquarters at Boise, Idaho)

This is the story of the first drawing in the northern part of the Columbia Basin project for 30 full-time farm units in Irrigation Block 40 in Grant County, Wash. This block of farms, to be served by the East Low Canal, includes farms from 49 to 125 acres each, located 75 miles south of Grand Coulee Dam, near three of the main project towns—Ephrata to the west, Moses Lake on the south and Soap Lake to the northwest. It represented the fourth such drawing for Columbia Basin project farms held by the Bureau of Reclamation.

It was poetic justice—not manipulation of the capsules—when pretty Mrs. Helen Bator became the first person in the audience to be announced as the holder of 1 of the low 30 priority numbers established at the public drawing in Moses Lake, Wash., on March 15, 1951.

With Mrs. Bator's excited acknowledgment of her name as a winner, the high-school band burst into a fanfare, and press and newsreel photographers happily concentrated on their attractive target.

Mrs. Bator was ushered to the stage where the Moses Lake Chamber of Commerce presented her with a "golden shovel" symbolic of the friendly and helping hand that was extended by the people of Moses Lake to the settlers who would soon be developing the nearby irrigated farms.

This was the climax to an impressive program cosponsored by the Moses Lake Chamber of Commerce and the Bureau of Reclamation, which featured talks by representatives of the city, State, and Nation. The speakers proclaimed that this moment represented the culmination of a cooperative effort that began long before the turning of the first dirt for the construction of Grand Coulee Dam.

Among the 400 people who attended the drawing were 10 persons who had submitted applications before the end of the simultaneous filing period on January 8, 1951. Three of these were ncluded in the first 30 names drawn. Since there vere 30 farms offered by the United States, these 3 people were assured that they would receive further consideration by the Board of Examiners. Mrs. Bator, now a physical education instructor at Moses Lake High School, had actively helped her father during the war years of 1941 to 1945 with he various chores connected with the operation of his fruit ranch near Yakima, Wash. She applied as the spouse of a veteran of World War II when her husband was called back into active luty by the Navy.

The obvious joy that Mrs. Bator reflected as she received the news of the new opportunity offered her and her husband verified the belief of all those present that this was the land of heart's desire for many similar young families—the land where beauty never fades. THE END.

SYMBOL OF A GOLDEN FUTURE is this golden shovel presented o Mrs. Helen Bator by the Moses Lake Chamber of Commerce. Her name was drawn fifth for one of the Columbia Basin farms.

Radioactive Fertilizers

(Continued from page 135)

method is to use a 4-inch drill and place the phosphate in strips beside or around the plants. Phosphate at depths of 4 inches usually is most effective. This is called band placement, and often appears more effective than broadcast in relatively dry soil. In general, plants use (or recover) much more fertilizer phosphorus from soil which is kept moist through more frequent irrigations than from drier soil having fewer irrigations.

These are a few of the findings up to the present time. Research is being continued to obtain further verification of these findings. In addition, radioactive phosphorus is being used more and more to discover how much phosphorus is supplied by different soils, and to find out which crops can get the most out of soil phosphorus.

What's Ahead?

We must all recognize, however, that radiophosphorus is just one research tool—just one refinement in research techniques for one plant food. But it does help us to obtain information that previously was either impossible or difficult to get. Soil and plant scientists already are using other radioactive elements like zinc, iron, and calcium to find out more about these elements and how they behave in soils and plants. However, the soil problems before us in the irrigated West are many and varied and not all connected with plant nutrients. The problems on one soil are not necessarily the same as those on another soil. Varying climates and farming practices must be taken into consideration. We need many different research tools and much specialized know-how to solve these problems of making the most of our soil and water resources.

A small but industrious team of State and Federal researchers are pushing the job. This team is aided by such agencies as the Bureau of Reclamation and the Extension Service, and by commercial companies. They are trying to solve agricultural problems on both the older irrigated areas of the West and lands which are being, or are to be, brought under irrigation in the near future. The answers they get to these problems will take the gamble and guesswork out of farming and guarantee a profitable and stable agriculture for the Nation.

Thus, quietly and undramatically, more and more scientists are developing atomic energy for its intended purpose—to enrich, not destroy, mankind. THE END

Pasco's Prosperity Pattern

by ROBERT O. ROGERS, Agricultural Economist, Columbia Basin Project, Region 1 (headquarters at Boise, Idaho)

GONE ARE THE DAYS when farms abandoned for lack of wate (as shown above) will be seen in this region—soon to be o irrigated paradise, and already demonstrating its possibilitie

THE PASCO PUMPING AREA OF THE COLUMBIA BASIN PROJECT, a tract of 5,400 acres of good quality land lying 10 miles northwest of Pasco, Wash., has been under irrigation during the past 3 years. It provides a practical demonstration of what may be expected with the development of the million acres of potentially irrigable land to be served by the project irrigation works.

Settlers on the Pasco Pumping Unit received one-half million dollars gross income from crops grown on 4,108 acres in 1950, an average of $122 per acre irrigated. Some crops, such as onions, sugar beets, and potatoes produced gross returns of over $260 and $340 per acre. In addition to revenue received from crops, some farmers have added to their returns by including livestock in their farm programs. Dairy herds are increasing in importance. Also beef cattle, hogs, and poultry are demanding interest. Several grade A dairies have been established which should ease the short milk supply in the Tri-City area, and operator returns have been good on thse ventures.

Of the million-acre Columbia Basin projec lands in the Pasco Pumping Unit, or Irrigatio Block 1, were the first to receive water. About 3 percent of the land in the block is class 1, 36 pe cent is class 2, and 26 percent is class 3. The qual ity of land on this block is varied but on the whol it is slightly better than the project average. Th growing season ranges from 140 to 170 days whic compares favorably with the rest of the projec

Water was first delivered to farmers on th Pasco Pumping Unit on May 15, 1948. Althoug water became available late in the season, six unit irrigated a total of 119 acres the first year. I 1949, the second year, 55 units were operated wit 2,249 acres being irrigated. In 1950, the thir year, 63 units were irrigated and 3,974 acres or 7 percent of the total acreage in the block wa cropped.

In 1950, Pasco farmers used most of the acreag for dry red Mexican and Pinto beans, Kenland re clover seed, alfalfa hay, and potatoes. Crop yield have been good. Kenland red clover seed, includ ıg first year plantings, averaged 200 pounds per cre in 1950 but yields of up to 800 pounds per cre have been obtained. Dry beans have been a ery satisfactory crop, yielding an average of 32 ushels per acre, with yields running as high as 0 bushels per acre. Potatoes averaged 13 tons er acre but some operators made yields of 16 tons er acre. Alfalfa hay averaged about 3.6 tons per cre including cuttings from first year crops, and ields up to 9 tons per acre were made. Yields milar to these are expected on other blocks of he Columbia Basin project the first of which is to eceive water beginning in 1952.

An example of a typical farm program on the etter land class is provided on the farm of Mr. . R. Thurman. His cropping pattern consists f 3 acres of field corn, 8 acres of Kenland red lover for seed, 7 acres of alfalfa hay, 11 acres f dry beans, 2 acres of early onions, 16 acres of arly potatoes, 1 acre of rape for hog pasture, acres of tame seeded pasture, and 2 acres of sudan rass. His livestock consisted of 11 dairy cows, 12 ead of dairy young stock, 3 brood sows, 15 other ogs and a small number of chickens. To be successful, a farm program of this kind requires a ood knowledge of farming and an investment anging from $25,000 to $35,000. It is a well-iversified program and should provide good reurns even in years when prices of one or two of he crops in the rotation are low.

A typical specialized farm on the Pasco Pumpng Unit in 1950 had 43 acres of red Mexican eans and 20 acres of Kenland red clover for seed. The operator owned no livestock. The investnent on farms similar to this one ranges from 15,000 to $25,000, depending upon the kind of ouse and whether or not the operator has a well or domestic water. In years of high prices for he crops grown on this farm the operators' reurn will be high but the chances of having some ears of poor returns are much greater than on arms with the more diversified crop program. In 950 the returns were poor for operators who pecialized in late potatoes and onions or both. Some farms on the block were planted entirely to eans in 1950 and a few were planted entirely to ither Kenland red clover or alfalfa for seed. Other crop rotations included one or more of the following crops: barley, corn, oats, wheat, clover seed, alfalfa seed, alfalfa hay, other hay, pasture ima beans, sweet corn, dry beans, onions, and potatoes.

PASCO PRODUCTS—This lush bean crop is typical of irrigated developed lands in the Pasco Pumping area of the Columbia Basin project only 3 years after the first water was delivered.

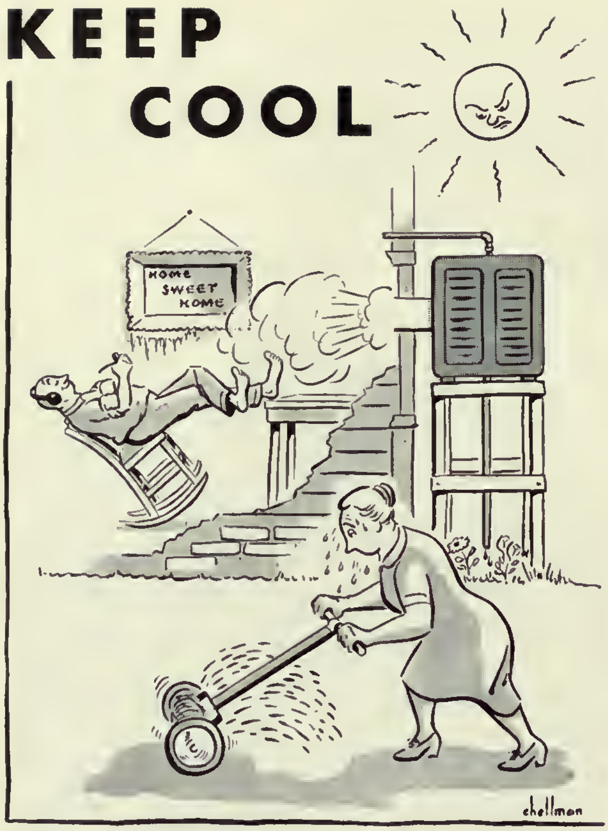
During the first years of development the irrigation blocks in the vicinity of Quincy, Moses Lake, and Othello are expected to have similar rates of development, enterprise patterns, crops, and crop yields. As the development period nears completion, more land is likely to be put into more permanent crops, such as asparagus, grapes, mint, hops, fruit, forage crops, and pasture. THE END

McClellan Receives Engineering Council's Gold Medal

Colorado's engineering profession paid the highest tribute at its command to the Bureau of Reclamation's Chief Engineer, L. N. McClellan, in Denver, Colo., on April 18, when the Colorado Engineering Council, made up of the local chapters of 20 professional societies, bestowed upon him the Gold Medal Award, acknowledging distinguished service in the field of engineering.

This award has been given only four times previously since it was originated in 1930, John L. Savage, formerly Chief Designing Engineer of the Bureau, being one of those so honored. •

KEEP COOL



WITH WATER IN THE WEST so valuable, each of its many use is of great importance in water resource conservation and develop ment. People living in areas more lavishly endowed with wate may take such things as water-provided air-conditioning fo granted, but in the West it is another of the many benefits of rec lamation, worthy of serious consideration. ***Drawing by th Graphics Section, Washington, D. C., based on author's sketch***

by D. A. DEDEL, Chief of Programs Section, Division of Programs and Finance, Region 3, Boulder City, Nev.

IF YOU LIVE IN THE ARID SOUTHWEST, "keeping cool" is more than just a phrase to you—and you already know all about desert coolers. But if you live elsewhere in the Nation, you will be interested to learn how we of the desert manage to live very comfortably in summer temperatures of 95 to 110 degrees.

Several methods of mechanical cooling exist for use in offices or private dwellings. If you are wealthy enough to afford a refrigeration cooling system for your home, you are lucky; it is perhaps the best method of cooling available. But if you are a Government employee, a homesteader on a Reclamation project, or the like, you cannot afford the expenditure of $1,000 to $1,500 for your modest dwelling and by necessity will be forced to use the next best system—the evaporative type cooler.

If you remember your high school or college physics, you may recall an experiment in physics laboratory which was usually called the wet and dry bulb thermometer, or hygrometer, experi ment.

The instrument you used consisted of two ther mometers, one of which gave the true tempera ture of the air. The other thermometer, the bul of which was covered with a wet cloth, gave temperature that varied with the rate of evapora tion of the water into the air. The drier the air the greater was the evaporation from the wet bul and the lower the temperature indicated by th second thermometer. When the air was saturated there was no evaporation from the wet bulb, an both thermometers indicated the same tempera ture. Physics class is now dismissed!

Here is how that principle in physics is use in keeping cool at desert temperatures. Unde normal summer temperatures, the percent o humidity is very low, ranging from 5 to 12 per cent. The rate of evaporation is very high unde such conditions; and, as the wet bulb physic experiment showed, a drop in temperature exist near a place where evaporation is taking place

The early Pueblo Indians in this part of th country learned this principle, not from the stud of physics but from experience. They covere the windows and doorways of their pueblos facin the direction of the prevailing winds with a porou blanket kept constantly wet. The hot winds passing through the wet blanket, caused evapora tion and dropped the temperature of air enterin the interior of the pueblo by several degrees We moderns, of course, must use a more con venient method—hence, we have the evaporativ type cooler.

The modern cooler consists of a metal box meas uring approximately 3 feet square and 3 feet high Three of the cooler's vertical sides contain a serie of horizontal louvers, or panels. The fourth sid is solid except for an 18-inch square opening nea the top, used as an air outlet. The top and bottom of the box are solid metal. Each of the vertica louvered sides is lined inside with an excelsior pa about 2 inches thick. This pad is kept constantl wet by a supply of water delivered through a smal perforated pipe lying along the top of each excel sior pad. A large squirrel-cage rotary fan, operated by a 1/4- or 1/3-horsepower motor, is mounted inside of the box. The fan draws hot air through the wet excelsior, thus causing a high rate of evaporation, and cooling the air inside of the box so that the temperature drops between 20° and 25°.

The cooler can be placed in the window of a dwelling for direct delivery of cool air inside a room. Or, in a large installation, it can be placed on the roof, and the cooled air distributed by a duct system to all parts of the house.

For the average size dwelling, a cooler costing approximately $250 and delivering from 3,000 to 4,000 cubic feet of cool air per minute is used. So, when the temperature outside is bearing down at 100°, you can keep cool with 75 or 80 degrees inside. It's a household necessity. With apologies to a certain automobile manufacturer, "Ask the man who owns one." THE END.

Canals for Sacramento Valley

(Continued from page 139)

grown pasture and grain on 700 acres of fertile soil in Colusa County. He told a congressional committee, "one acre of irrigated land is equal to 5 acres of dry land. We have 40 percent increase in population which is additional expense to the community in the way of schools, transportation, and many other ways. This improvement would increase assessments, produce increased revenue, and provide employment for increased population."

Thomas B. Kees of Corning, Calif., county supervisor and chairman of the committee's Tehama County unit, has been producing and processing world famous California olives from his 65-acre grove for the past 25 years. He told Congress, "If our pumps decrease the water supply as fast in the next 15 years as they have in the past 10 years, we will have no water in our wells with which to irrigate our orchards and our small crops." He explained that the wells varied from 40 to 440 feet deep, with some 500-foot wells in some of the high locations. In reply to questioning by the congressional committee, he added, "Our water table is going down so fast that if we do not get some relief we will not have any water. We have a lot of valuable lands. For instance, I have an orchard, I do not mind telling you, for which I was offered $1,500 per acre. Without the water it is not worth $25 per acre."

P. V. Harrigan, secretary of the Glenn County unit of the Sacramento Valley Irrigation Committee, raiser of Ladino clover and livestock, told Congress, "For the past 10 years I have interested myself in attempting to bring water to a higher elevation than the present irrigation canals. After we worked out every avenue locally, you might say through private enterprise, it was found physically impossible to attempt a project of this kind because of the slope of the river, going through several counties." He cited the efforts made since 1866 to irrigate certain lands in the Sacramento Valley, and added, "Upon the completion of the Shasta Dam it was generally believed that a supporting canal system would be built. That is the thing we have been waiting for, for a number of years."

A. W. Bramwell, chairman of the committee's Butte County unit and a rice grower near Chico, also spoke before Congress, saying, "Water tables in Butte County from pumping are gradually receding. Water must be brought from the river for surface irrigation to continue to produce. This increase in valuation broadens the tax base, thereby assuring the early repayment of these improvements. As publisher of the Chico Enterprise-Record, I believe we interpret and reflect the opinion of our 35,000 readers, and we wholeheartedly support this project, as we believe it will be self-supporting and will pay back the cost in a reasonable length of time. We are asking your assistance in this investment. The canal project has met with the unanimous support of all the organizations of Butte County and particularly from other county, Farm Bureau and Grange Units. Committees from these organizations have worked with the chamber of commerce and our irrigation committee to gather material in support of this project. They have urged me to attend this hearing to present their case and are paying my expenses to Washington to do so."

And the enactment of Public Law 839 was the reward for 2 years of this kind of work. It was not easy. Oliver J. Carter, Chairman of the Democratic State Central Committee of California, now Federal Judge in San Francisco, wrote to the President of the United States offering his support for the legislation and said, "As far as I can determine, there is no opposition to the proposed bill. In fact, there is a militant organization of farmers and businessmen in the Sacramento Valley which is vigorously advocating passage of it. Companion bills have been introduced by Senators

Downey and Knowland and also Representative Hubert B. Scudder of the First Congressional District of California. You will be interested to know that the legislation is being advocated by a number of groups and individuals in California who have violently disagreed on some phases of the reclamation program. It is certainly significant that on these proposed features of the Central Valley project, there is unanimous approval and unanimity of opinion."

That was the key to our success. When we met at a Victory Dinner on October 12, 1950, James K. Carr, at that time District Manager for the Bureau of Reclamation's Sacramento Valley, summed up our activities when he said, "The recent approval by the Congress and President Truman of the Sacramento Valley Irrigation Canals, as a part of the Central Valley project, and the vision of new farms and new homes that will eventually be established in the Sacramento Valley when these canals are completed, certainly gives us good reason to rejoice—to celebrate—as we are doing on this memorable occasion." He stated another reason for jubilation, "we have been part of an outstanding example of cooperation between State and Federal agencies and the people of four California counties—we have witnessed an inspiring example of American democracy at work."

With this example before us, we shall continue working together until, as Charles Lambert of Willows said, "The upper Sacramento Valley is green from foothill to foothill, not just a fringe along the river." THE END

Parker Trouble Shooters

(Continued from page 145)

Observation of the unit after modification disclosed that the vibration set up by the vortex trails at the trailing edge of the runner blades had been completely eliminated. From the inspection, the engineers concluded there was no need for concern over possible increased erosion or pitting caused by the larger opening between blades—paint marks on the blades made during the tests in July were plainly undisturbed.

The payoff of this engineering success was threefold.

First, eliminating the vibration and thus stopping the cracking of the runner blades saved replacing them, at a cost of at least a half million dollars.

Second, the basic data derived from the tests and analyses are invaluable in establishing precedents for future designs of large turbine runners.

And third, of particular interest to those who use Parker plant's power, the output of the Parker turbines, resulting from streamlining the runner blades, has been increased by almost 5 percent, representing additional power for people in the area—power for pumping irrigation water, for turning the wheels of industry, and for the many labor-saving and comfort-giving devices which depend upon available electricity. THE END

Chapman Extends Deadline for Comments on Colorado River Storage Project

Secretary of the Interior Oscar L. Chapman extended the deadline for official comments on the proposed Colorado River Storage project and participating projects from May 15 to June 15. The extension was formally requested by the Upper Colorado River Commission and the States of Arizona, Colorado, and Utah. Only comments received so far are from Wyoming and Nevada. The States in the upper basin are Utah, Wyoming, Colorado, New Mexico, and Arizona.

The report outlines a program through which the five States in the upper basin can put to use their share of Colorado River water apportioned among them under the Upper Basin Compact. The report provides for storage of 48.5 million acre-feet of water in a series of 10 dams on the Upper Colorado and its tributaries, hydro power plants with an installed capacity of more than a million and a half kilowatts and irrigation for 2 million acres of land. •

Valley Division of Yuma Project To Be Taken Over by Water Users

The Yuma County Water Users' Association plans to take over operation of the Valley Division of the Yuma project by July 1 or as soon thereafter as is feasible. The actual take-over is expected to be gradual and members of the Association began to familiarize themselves with the duties performed by Reclamation Bureau personnel as early as April.

The first move in changing the Association into an operating agency was to hire Harry S. Riddell of Delano, Calif., as manager. His background qualifies him adequately for the job, having served as city engineer in Susanville, Calif., and as project manager of the Southern San Joaquin Municipal Utility District. Under the reorganization the operation of the project will be divided into three divisions—watermaster, administrative, and maintenance—all under the jurisdiction of the project manager. •

Power Plant Planned for Deer Creek Dam

Secretary of the Interior Oscar L. Chapman recently announced that the Bureau of Reclamation plans to build an 8,000-kilowatt capacity hydroelectric power plant at Deer Creek Dam on the Provo River project in Utah.

The Provo River Water Users Association, whose repayment contract provides for the construction of the plant either by the Bureau or the Association, has urged early construction. Secretary Chapman, in a letter to the Association's President, J. W. Gillman, pointed out that the Bureau of Reclamation had planned for the power plant and had already spent considerable money for the installation of a powerhouse substructure, penstocks, and other facilities to speed up the later installation of the power facilities.

However, the delay in starting construction was largely due to the uncertainty as to the final recommendations regarding the initial stage development of the Central Utah project with which the Deer Creek Reservoir must be coordinated for operation. The report on Central Utah has now been completed and submitted to the Colorado River Basin States for review, thus, removing one of the last major obstacles to construction of the Deer Creek power plant.

This power will provide a valuable resource from the defense standpoint and can be developed quickly with little capital investment as the majority of preliminary construction has been completed. Plans are being prepared for the installation of automatic, or semi-automatically operated, generating facilities at Deer Creek plant. As soon as the preliminary studies are completed Congress will be asked to provide for completion of the plant at the earliest practicable time. However, Secretary Chapman in his letter to Mr. Gillman said that he could not give any assurance as to the starting date of construction. •

GOVERNOR ALLEN SHIVERS OF TEXAS signs the bill ratifying the Canadian River compact among Texas, Oklahoma, and New Mexico, on May 10, 1951, thus paving the way toward congressional approval of the tri-State compact and eventual construction of the Canadian River project (see article on page 48, March 1951 issue, *Reclamation Era*). Oklahoma and New Mexico governors had previously signed legislation approved by legislatures in those States so that the Bureau-planned and authorized 86-million-dollar project could provide municipal and industrial water supplies for 11 cities in the Panhandle-Plains area of Texas. Looking on as the Lone Star State's governor signs the compact bill are, left to right, Senator Grady Hazlewood, Representative Harold LaFante, Senator K. B. Corbin, A. A. Meredith, city manager of Borger, Tex., and E. V. Spence, former chairman of the Texas Board of Water Engineers. *Photo by Neal Douglass, Austin, Tex.*

Salt Lake Aqueduct in Operation

On May 1, 1951, Salt Lake City's Metropolitan Water District assumed operation and maintenance of the Salt Lake Aqueduct, a 41-mile pipeline which is the principal feature of the Aqueduct Division of the Provo River project, and represents one of the first instances in Bureau history wherein an irrigation project was extended to supply muncipalities with water currently in excess of project irrigation needs.

The Provo River project also supplies domestic water to six other municipalities, including Provo, in addition to furnishing a supplemental water supply for irrigating about 46,000 acres of highly productive farm lands in Salt Lake and Utah Counties.

Until the terminal reservoir is completed (scheduled for December 1951) the Aqueduct can be operated in three different ways: (1) bypassing the terminal reservoir and discharging into the existing Samuel C. Park Reservoir; (2) bypassing Park Reservoir and discharging directly into the City's feeder main; or (3) spilling into Parley's Creek via an emergency overflow structure and wasteway conduit. •

BUREAU RELEASES THREE NEW MOTION PICTURE FILMS

RESEARCH on the Yakima project, one of the many cooperative activities between the Bureau of Plant Industry and the Bureau of Reclamation. Vic Bruns of BPI is checking on quack grass.

GIANT CATTAILS on Arizona's Yuma project, inspected by weed specialist Curtis W. Bowser. Various chemicals, including TCA mixed with 2,4–D, may wipe out this weed.

NEW MACHINE on the Tucumcari project in New Mexico, scoops weeds out of hogwire trap. All photos are scenes from the new colored movie film "Weed Control on Irrigation Systems."

Three half-hour 16-millimeter mo pictures have recently been release the Bureau of Reclamation as vi educational aids. Corralling the C rado has already been seen on Nation's television screens, both in East and the West. This black white film, with sound, contains s of the famous footage showing the struction of Hoover Dam. Watc the West, another black and white will be released this summer. A c film, Weed Control on Irrigation tems, has just been completed, shows the problems of weed control the most recent developments in w control methods and equipment. W the film was designed primarily for benefit of operating personnel—bo of directors, irrigation superintend and managers, watermasters, di riders and maintenance crews should be of interest to project farı as well. It will be used by many l schools and colleges where agricult and irrigation courses are taught. addition to the motion picture, a s lecture of colored slides has also l released on the same subject, for where 16-millimeter sound projec equipment is not available.

All three of the films may be obta from Bureau of Reclamation Regi Directors (see directory on the in back page of this issue) or from Commissioner, Bureau of Reclamat Washington 25, D. C. No rental cha are made for the use of the films slides, and the only cost to the borro is for transportation from, and ret to, the office from which they obtained. ●

WATER REPORT

1c irrigation water forecast as of
1 remaiued about the same as that
ast month. Farmers can look for
rally adequate to plentiful water
lies throughout the seventeen
tern States except in the Southwest.
ation water will be in short sup-
in the San Joaquin Basin, and ex-
ely short in the Salt River and
Grande basins. Floods of record
king size occurred in Oklahoma and
sas during the month of May.
d stages were reached on several
ms in northern Utah, and Great
Lake recorded its highest elevation
e 1931. Tributary runoff was gen-
ly excessive in the Columbia River
u but the peak flow at The Dalles
below normal, so that there is little
o likelihood of disastrous floods this
ng. Severe drought persisted in the
hwest, particularly in western New
ico. Many farmers of the Rio
nde project are drilling wells to
in supplemeutal irrigation water,
e the depleted storage supply for
project is being strictly rationed.

y regions, the situation is as follows:

EGION 1—outlook is generally ex-
ut. Last month we reported that
tributary watershed of the Yakima
ect had experienced the driest
l of record. In May, the situation
reversed, with precipitation over
area averaging 175% of normal.
Yakima project reservoirs were
efore used for flood control during
month, and were all practically
l on June 1. The first pump units
ping water from Franklin D. Roose-
Lake into the Grande Coulee Equal-
Reservoir were put into service
ng the month.

EGION 2—inflow to Shasta Lake
ng May was 111% of normal. As
sult, the reservoir reached a maxi-
n stage of record on May 26 with
ve storage of 3,914,500 acre-feet. In
rast, inflow into Millerton Lake
ng the month was only 68% of
nal.

EGION 3—storage in Lake Mead was
cted by the fact that snow runoff in
upper Colorado River Basin was
ut one month later than normal. As
sult, Lake Mead reached a minimum
ation for this year on May 11 (ele-
on 1149.19; active storage 16,483,000 acre-feet). This is the latest annual miuimum for Lake Mead since original filling of the reservoir. The drought abated slightly in Arizona with some precipitation occurring over the Verde River watershed. There was no appreciable inflow, however, into any of the Salt River project reservoirs, where water supply conditions remain critical.

REGION 4—floods occurred in northern Utah, while in southern Utah and southwestern Colorado, the drought continued with little relief. It is anticipated that irrigation water supplies will be sufficient for production of normal crops on all Bureau projects within the region, although on the Pine River project iu southwestern Colorado this will be accomplished only through rationing of the available storage supply from Vallecito Reservoir and strict observance of conservation measures by the water users.

REGION 5—as a result of heavy precipitation in Oklahoma during May, the Altus Reservoir of the W. C. Austin project filled to overflowing. There was slight relief from the drought in northeastern New Mexico but no relief at all in the Rio Grande Valley in western New Mexico and Texas. Storage in reservoirs of the Rio Grande project at the end of May set another new record low.

REGION 6—irrigation prospects are very good on all except the Belle Fourche project in South Dakota where stream flows into the Belle Fourche Reservoir have continued below normal.

REGION 7—all reservoirs are well-filled and irrigation prospects are from good to excellent. ●

CROPS

Reclamation Crops Exceed 13 Million Tons

Reclamation farms through the 17 western States produced more than 13 million tons of crops, worth more than one-half billion dollars, last year.

These farms totaling about 5 million acres were all served in whole or part by water from Reclamation facilities. Latest figures show that the Bureau furnished water for the first time to 275,546 acres of full- and part-time farms during 1950. The Central Valley project in Region 2 in the State of California ranked first in the amount of irrigated lands, with 2,145 farms totaling 172,205 acres receiving an initial supplemental water supply during the year.

New acreages being served for the first time during 1950 included 29,211 in Region 1; 10,381 in Region 3; 11,901 in Region 4; 31,563 in Region 5; 18,572 in Region 6, and 1,713 in Region 7. ●

LETTERS

Overseas Interest

SEIDENSTRASSE, VIENNA, AUSTRIA,
March 9, 1951.

To United States Bureau of Reclamation, Denver, Colo.

In our fortnightly magazine "Landwirtschaftliche Machrichten aus den Vereinigten Staaten" (Agricultural News from the United States), edited by the United States Commission for Austria, we published an article about the new clay analysis worked out by scientists of the United States Bureau of Reclamation at Denver, Colo. As a source for the article which appeared in issue No. 97 of February 1, 1951, we used a State Department press release from Washington, D. C.

High interest in the new method was raised by this article in competent Austrian circles. We therefore ask whether you would be able to send us more detailed information about this analysis, including, perhaps, photos or drawings.

For your information we add to this letter a copy of the press release used by us (in English) as well as the issue of our magazine in which the article appeared (in German).

Yours very truly,

CARL H. PETERSON,
Press Officer.

(The Bureau's Denver, Colo., office received the above letter along with numerous other requests for additional information on this subject which leads us to believe that D. L. Goodman's article, "Color Tests for Clay" which appeared in the November 1950 issue of the RECLAMATION ERA has stimulated widespread interest in the work of the Bureau of Reclamation.—Ed.)

Asia Earthquake Affects Texas Water Wells

The Geological Survey reports that water wells in Texas and Florida rose and fell in relation to the earthquake tremors in Burma, China, and Tibet last August. This seems to substantiate the theory that the earth is a single geological unit. ●

NOTES FOR CONTRACTORS

Contracts Awarded During May 1951

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Cont amo
DS-3240	Central Valley, Calif.	May 28	10 turbine-type and 2 centrifugal-type pumping units for Trauger pumping plant, Lindsay-Strathmore irrigation district, Friant-Kern canal distribution system.	Food Machinery and Chemical Corp., Los Angeles, Calif.	$132
DC-3295	Eklutna, Alaska	May 7	Erecting 142-foot by 55-foot steel warehouse building for Eklutna government camp.	Sandvik, Roark and Ray F. James, Palmer, Alaska.	70
DS-3297	Missouri River Basin, Wyo.-Mont.	May 24	2 portable oil purifiers and 2 filter-paper drying ovens for Boysen and Canyon Ferry power plants.	De Laval Separator Co., Chicago, Ill.	15
DC-3326	Boise, Idaho	May 29	Construction of 2.2 miles of 4.16-kilovolt transmission line and an electrical distribution system, and conversion of coal-fired furnaces to electrically heated furnaces for Anderson Ranch government camp.	American Electric Co., Caldwell, Idaho.	54
DC-3331	Colorado-Big Thompson, Colo.	May 18	Construction of North Poudre supply canal diversion dam, canal headworks, tunnels, and siphons, schedules 1, 3, 4, and 5.	G. L. Tarlton Contracting Co., St. Louis, Mo.	1,953
DC-3331	do	do	Construction of North Poudre supply canal, schedule 6	Adler Construction Co., Loveland, Colo.	750
DS-3335	Missouri River Basin, N. Dak.	May 21	4 controlling and 9 controlled station supervisory control and telemetering switchboard sections and associated equipment for Jamestown, Carrington, Devils Lake, Leeds, Rugby, Lakota, Edgeley, Forman, Bismarck, and Valley City substations, Central North Dakota power system.	Control Corp., Minneapolis, Minn.	83
DC-3337	Klamath, Oreg.-Calif.	May 16	Construction of earthwork and structures for lower Lost River channel improvement; North Main dike; strengthening dikes on Tulelake sump; bank reconstruction of N canal; and reconstruction of oultet works from pumping plant No. 5.	George R. Stacy, Tulelake, Calif.	38
DS-3342	Hungry Horse, Mont.	May 2	1 lot of metalwork for elevator towers and block 14 elevator shaft, Hungry Horse Dam.	Arrow Iron and Machine Works, Seattle, Wash.	15
DS-3344	Central Valley, Calif.	May 14	Three 74,000-horsepower hydraulic turbines for Folsom power plant.	Newport News Shipbuilding and Dry Dock Co., Newport News, Va.	1,629
DS-3345	Hungry Horse, Mont.	May 7	Spiral and inclined stairs for galleries, Hungry Horse Dam.	Nelco Products, Hollydale, Calif.	34
DS-3351	Colorado-Big Thompson, Colo.	May 21	Three 115,000-volt circuit breakers and eighteen 115,000-volt disconnecting switches for Flatiron and Pole Hill switchyards.	Pacific Electric Mfg. Corp., San Francisco, Calif.	12
DS-3355	Davis Dam, Ariz.	May 23	One 1,000 kilovolt-ampere unit substation for Phoenix substation.	Gough Industries, Inc., Los Angeles, Calif.	24
DC-3358	Cachuma, Calif.	May 3	Furnishing and installing 1 electric freight elevator for Tecolote tunnel.	Kimball Elevator Co., Ltd., Los Angeles, Calif.	10
DS-3360	Columbia Basin, Wash.	May 18	Structural steel for Chicago, Milwaukee, St. Paul & Pacific railroad bridge at Potholes East canal.	American Bridge Co., Denver, Colo.	18
DS-3365	Missouri River Basin, Mont.	May 29	4 radial-gate hoists for spillway at Canyon Ferry Dam.	Monarch Forge and Machine Works, Portland, Oreg.	71
DC-3368	Columbia Basin, Wash.	May 11	Construction of 70-foot by 150-foot machine shop building for Operation and Maintenance headquarters at Othello, Wash.	Cherf Bros. Construction Co., Ephrata, Wash.	124
DC-3369	Colorado River Front and Levee System, Ariz.-Calif.-Nev.	May 21	Construction of earthwork and structures for Yuma Levee, Lower Colorado River district.	Gibbons and Reed Co., Salt Lake City, Utah.	1,027
DC-3371	Grand Valley, Colo.	May 9	Construction of East Salt and Badger wash siphons and check on Highline canal, and siphon on lateral 21 AC.	Ross Construction Co., Provo, Utah.	200
DC-3372	Missouri River Basin, S. Dak.	May 29	Construction of 92.3 miles of Angostura canal, wasteways, laterals, sublaterials, and surface drains.	Peter Kiewit Sons' Co., Omaha, Nebr.	2,212
DS-3374	Rio Grande, N. Mex.	do	Supervisory control equipment for Albuquerque, Belen, Central, and Las Cruces substations, Las Cruces switching station, and Elephant Butte power plant, schedule 2.	Control Corp., Minneapolis, Minn.	27
DS-3377	Cachuma, Calif.	May 11	Structural steel for access bridge, Tecolote tunnel intake tower.	California Steel Products Co., Richmond, Calif.	18
DC-3378	Missouri River Basin, Wyo.	May 3	Contraction joint grouting of Kortes Dam.	C. M. Hanes Construction Co., Denver, Colo.	12
DC-3380	Kendrick, Wyo.	May 18	Construction of Sinclair-Hanna 34.5-kilovolt transmission line.	Sturgeon Electric Co., Inc., Denver, Colo.	84
DC-3433	Colorado-Big Thompson, Colo.	May 23	Drilling and grouting foundations for dikes Nos. 1 and 2, Granby dam and dikes.	Jones Core Drilling Co., Dallas, Tex.	64
117C-100	Columbia Basin, Wash.	May 7	Construction of Watermaster Office Bldg., storehouse, garages, and general purpose shop at O. & M. Headquarters, Winchester, Wash.	W. J. Park & Sons, Yakima, Wash.	93
200C-155	Central Valley, Calif.	May 9	Street and utility improvement and Imhoff tank at Toyon Government camp.	Tyson & Watters, Inc., Sacramento, Calif.	112
300C-12	Davis Dam, Ariz.-Nev.	May 2	Construction of Knob substation	Arrow Construction Co., Yuma, Ariz.	77
300C-20	do	May 14	Construction of operator's house at Tucson substation	Leonard Daily, Tucson, Ariz.	15
400C-26	Grand Valley, Colo.	May 28	Earthwork and channel slope protection in Big Salt Wash	Colorado Constructors, Denver, Colo.	15
604C-22	Missouri River Basin, Mont.	May 7	Clearing areas 3 and 4 of Canyon Ferry Reservoir	Thompson-Kirkwood Co., Billings, Mont.	19
704C-181	Colorado-Big Thompson, Colo.	May 10	Landscaping Estes Power Plant	Southwest Contracting Co., Florence, Colo.	12

Construction and Materials for Which Bids Will Be Requested by September 1951

Project	Description of work or material	Project	Description of work or material
Boise, Idaho	Two 7,200-volt circuit breakers for Anderson Ranch power plant.	Central Valley, Calif.	Construction of 25 miles of 12- to 36-inch dian concrete irrigation piple lines for the Stone-C irrigation district, Friant-Kern canal distrib system, near Seville, Calif.
Cachuma, Calif.	Construction of 12 miles of 36- to 27-inch diameter concrete pipe conduit for part of the Carpinteria section of the South Coast conduit near Santa Barbara, Calif.	Do	Construction of 115- and 69-kilovolt switch extension at Tracy switchyard.

Construction and Materials for Which Bids Will Be Requested by September 1951—Continued

Project	Description of work or material
ral Valley, Calif	Erection of two prefabricated metal buildings with concrete floors to store transmission line materials and equipment at Elverta and Orland, Calif.
Do	One 20,000-kilovolt-ampere and two 5,000/6,250-kilovolt-ampere transformers for Folsom power plant.
rado-Big Thompson, lo.	Clearing trees and brush in Willow Creek reservoir and south side access road, 6 miles north of Granby, Colo.
Do	Installing electrical equipment in Green Mountain switchyard addition, near Kremmling, Colo.
mbia Basin, Wash	Construction of 59 miles of laterals and wasteways in lateral area P-4, Potholes East canal, near Othello, Wash.
Do	Construction of 17 miles of unlined laterals in lateral area P-2, Potholes East canal, near Othello, Wash.
Do	Construction of wasteways for laterals EL-16 and EL-18 in lateral area E-1, East Low canal, near Moses Lake, Wash.
Do	Construction of 85 miles of unlined laterals and wasteways for lateral area W-5, West canal, near Winchester, Wash.
Do	Construction of a 650-foot unlined wasteway turnout from West canal, with stop-log overflow section and two 6- by 5-foot slide gates and hoists, 6 miles south of Quincy, Wash.
Do	Construction of two 35 cubic-foot-per-second capacity pumping plants near Soap Lake, Wash.
Do	Construction of Lower Scooteney pumping plant (PE-27), 76 cubic-foot-per-second total capacity at 149-foot total discharge head; and Upper Scooteney pumping plant (PE-27A), 24 cubic-foot-per-second total capacity at 97-foot total discharge head, and 2,200 feet of unlined lateral.
Do	Construction of office building, general purpose shop, warehouse, two garages, and eight residences with unattached garages at Eltopia, Wash.
Do	Completion of electrical wiring for underground distribution system in industrial area and removal of existing overhead distribution system; construction of heating plant substation and electrical installation in heating plant; removal of existing heating plant; installation of substation for caisson drydock; and revisions to distribution line to North Coulee Dam, all at Coulee Dam, Wash.
Do	Furnishing and installing chain-link fencing along section of feeder canal and for fuel storage plant in industrial area at Coulee Dam, Wash.
is Dam, Ariz.-Nev	Erection of steel structures and installation of electrical equipment for 20,000-kilovolt-ampere Cochise substation.
Do	Main control board for Prescott substation.
utna, Alaska	Two 16,667-kilovolt-ampere vertical-shaft generators for Eklutna power plant.
Gila, Ariz	Construction of 28 miles of unreinforced concrete-lined Mohawk laterals and sublaterals, Unit 1, and appurtenant reinforced concrete structures near Roll, Ariz.
Kendrick, Wyo	Construction of 36 miles of 34.5-kilovolt transmission line between Seminoe dam and Bairoil, Wyo.
Do	Construction of 35 miles of double-circuit telephone line from new Casper substation to Alcova dam, Wyo.
Do	Construction of sidewalks, 1 mile of streets, and sewage and water systems near Alcova Dam.
Do	Construction of 12 two-bedroom houses at Alcova Dam.
Minidoka, Idaho	Three 11,100-kilovolt-ampere generators for American Falls power plant.
Missouri River Basin and Fort Peck, Mont.	Moving temporary houses, trailer houses, office and warehouse to Tiber dam government camp; constructing foundations and connecting utilities. Moving a house 60 miles to Havre substation near Havre, Mont., and placing on previously constructed foundation.
Missouri River Basin, Nebr.	Construction of 11 miles of unlined and 2 miles of concrete lined reaches of Courtland canal, near Superior, Nebr.
Missouri River Basin, N. Dak.	Construction of 1,500-kilovolt-ampere Custer Trail substation, near Bismarck, N. Dak.
	Construction of 2,500-kilovolt-ampere DeVaul substation, 11 miles southeast of Almont, N. Dak.
Missouri River Basin, S. Dak.	Construction of Huron, Watertown, Sioux Falls, and Mount Vernon 115-kilovolt substations.
Do	Construction of 25,000-kilovolt-ampere Brookings substation.
Do	Construction of 15,000-kilovolt-ampere Lone Tree substation.
Do	First stage construction of 10,000-kilovolt-ampere Woonsocket substation.
Do	Moving two houses from Bixby government camp to Angostura dam site camp, erection of houses and construction of utilities.
Missouri River Basin, Wyo.	Relocation of Chicago and Northwestern railroad and telegraph line along Boysen reservoir, near Riverton, Wyo.
Do	Construction of 2,000 feet of Alcova switchyard road, 32 miles southwest of Casper, Wyo.
Do	Exploratory drilling at dam sites, tunnels, and other major structures in the Wind and Clarks Forks divisions and Shoshone extensions unit of Missouri River Basin project in Fremont, Park, Big Horn, and Hot Springs counties, Wyo.
Rio Grande, N. Mex	Construction of 20 miles of Rio Grande River drainage and conveyance channel and levee above Elephant Butte reservoir.
San Luis Valley, Colo	Construction of operating road at Platoro dam site 35 miles northwest of Antonito, Colo.

United States Department of the Interior
Oscar L. Chapman, Secretary
BUREAU OF RECLAMATION OFFICES

Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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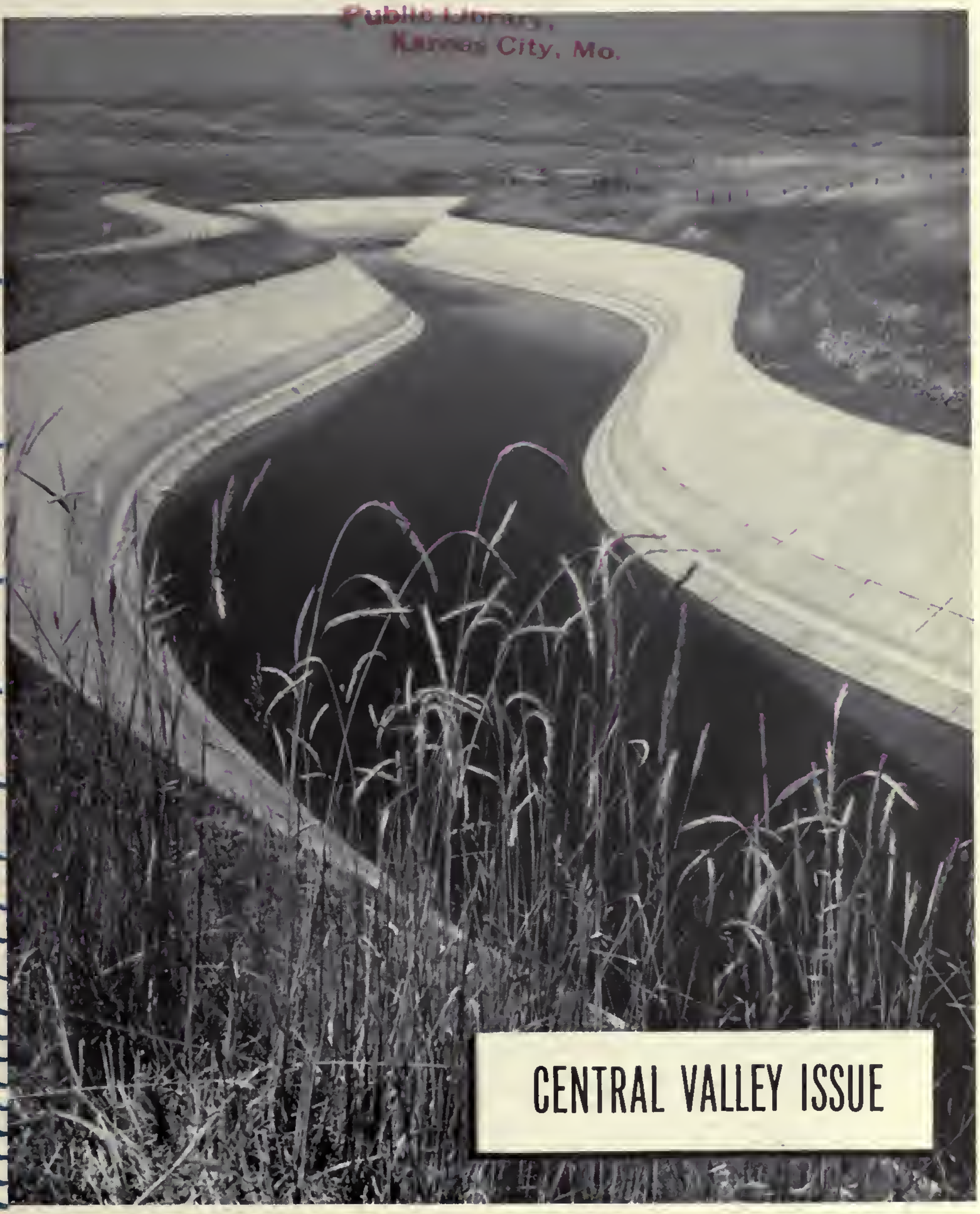
U. S. GOVERNMENT PRINTING OFFICE: 1951

THE RECLAMATION AREA

The Reclamation ERA

August
1951



CENTRAL VALLEY ISSUE

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CONTENTS

FEATURE ARTICLES

SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1.50 a year for persons residing in the United States and Canada; $2 a year for foreign subscriptions; special rate of $1 a year for members of water users' associations, and Bureau of Reclamation employees.

OUR FRONT COVER

"for amber waves of grain"

America's beauty and bounty, its productivity and opportunity, are exemplified in this photo by Region 2's Chief Photographer Ben Glaha showing the Friant Kern Canal flowing past a field of golden grain. As the Central Valley project goes into full integrated operation this month, the Friant Kern Canal, a 60 million dollar man-made river, will carry water 153 miles from Madera to Kern county—and some of the 15-foot-deep flow will be made up of Sacramento River water, lifted over the Delta by the gigantic Tracy Pumping Plant, which transfers life-giving water from one river basin to another.

30 YEARS AGO IN THE ERA

Recovery has been halted by the continuance of strif in all the great foreign market centers. Our abundant sur plus crops have moved out slowly and at diminishing prices Taxes of every imaginable sort have been imposed until th burden of the people is staggering. The farmer suffere most because he was hit first. The prices for what he ha to sell fell sharply long before there was any appreciabl drop in what he had to buy. Slowly the equilibrium bega to be restored. The balance is still on the wrong side be cause of the failure of the retailer to take his loss on hi stocks purchased at war prices. He is still forgetful o the fact that he sold his prewar stock at war prices, an that it is but fair for him to accept a loss on present stock in order to more quickly bring about a readjustment o conditions.

(From the August 1921 issue of the Reclamation Recor predecessor to the Reclamation Era.)

RECLAMATION PLACE NAMES IN THIS ISSUE

SENATE CONCURRENT RESOLUTION NO. 47

Relative to the Central Valley Project

INTRODUCED by Senators Jesse M. Mayo, Harold T. Johnson, George Miller, Jr., Jess R. Dorsey, Gerald O'Gara, Roy Cunningham, Hugh P. Donnelly, Verne W. Hoffman, George J. Hatfield, Arthur H. Breed, Nathan F. Coombs, Ed. C. Johnson, H. E. Dillinger, Harold J. Powers, Earl D. Desmond and Hugh M. Burns of the California Legislature.

WHEREAS, In seeking to bring about the fullest development of the waters of our State for beneficial uses, the Legislature, nearly 20 years ago, authorized the Central Valley project to provide for the collection and transfer of a portion of the plentiful waters in the northern part of the Central Valley for distribution in parched lands in the southern portion of the valley; and

WHEREAS, On August 1, 1951, the first water destined to be transferred from Sacramento Valley to San Joaquin Valley, will be spilled from the Shasta Dam; and

WHEREAS, This transfer of water marks the first integrated operation of the initial features of the Central Valley project; and

WHEREAS, The water so released on August 1, will flow, during a 10-day period, through the Sacramento River, the Sacramento Delta, through the Cross Channel to Tracy, and through the Delta-Mendota Canal 120 miles to the Mendota Pool to replace water that would normally flow down the San Joaquin River and permit the diversion of that water at Friant Dam through the Friant-Kern Canal to the Kern River at Bakersfield; and

WHEREAS, The magnitude of the works necessary to accomplish the transfer of water is evidenced by the six 22,500 horsepower pumps at the Tracy pumping plant which will lift the water 200 feet at the rate of 2,000,000 gallons a minute; and

WHEREAS, The Central Valley project, constructed by the Federal Bureau of Reclamation, will provide water over 1,000,000 acres of land in the San Joaquin Valley which, for many years, has been suffering from an extreme water shortage, it containing two-thirds of the arid lands in the State and having only one-third of the water supply; and

WHEREAS, Many communities throughout the 500-mile length of the valley served by the project plan to hold celebrations in observance of the first transfer of waters; now, therefore, be it

Resolved by the Senate of the State of California, the Assembly thereof concurring, That the Legislature respectfully requests the Governor to proclaim, as the Central Valley Water Festival, a 10-day period of observance of the celebration of the completion of the initial features of the Central Valley project from August 1, 1951, through August 10, 1951; and be it further

Resolved, That the Secretary of the Senate is directed to transmit a copy of this resolution to the Governor of this State. •

WHEN GOOD VALLEYS GET TOGETHER the result is prize-winning asparagus and prize Holstein bulls, like the one below, raised in an area served by the Madera Canal, one of the arteries of the now-joined Sacramento and San Joaquin Valleys of the CVP.

CREATED FOR SERVICE

by

TOM HENNION, Editor

Tulare Advance Register, Tulare, Calif.

To FULLY UNDERSTAND THE CENTRAL VALLEY PROJECT, you must first understand the amazing valley it was created to serve.

The Central Valley actually is not one valley but two—the Sacramento and the San Joaquin—which roll for mile after endless mile through the very heart of California's great agricultural empire.

The watersheds of the two valleys combined make up the Central Valley basin. The combined watersheds extend nearly 500 miles in a northwest-southeast direction, and average about 120 miles in width. The basin is entirely surrounded by mountains except for a gap in the western edge.

The valley floor occupies about one-third of the basin. The other two-thirds is mountainous country. The Sierra Nevada Mountains rise on the east to more than 14,000 feet in elevation. The coast range on the west reaches elevations as high as 8,000 feet.

The Sacramento River with its tributaries flows southward and drains the northern part of the basin. The San Joaquin River with its tributaries flows northward and drains the southern portion.

These two river systems join at the Sacramento-San Joaquin delta near Stockton to find a common outlet through a gap in the coast range into San Francisco Bay and then into the Pacific Ocean. If it weren't for the Central Valley project, these waters would continue to be (as they have in the past) mainly wasted into the ocean, lost forever.

The Central Valley supports 1,500,000 people in its cities and towns and on its farmlands. Agriculture is the predominant industry. And agriculture demands water.

The Central Valley project was designed to provide that water, or rather to rearrange the distribution of water so that the bulk of it would go where it would do the most good—in the highly agricultural southern portion of the basin, the San Joaquin Valley.

The agricultural richness of the Central Valley is almost unbelievable. The valley grows 200 different crops.

The principal ones are cotton, alfalfa, irrigated pasture, sugar beets, beans, barley, and rice among the field crops; asparagus, tomatoes, melons, and a variety of other vegetables; fruits and nuts, including grapes, peaches, plums, apricots, pears, figs, walnuts, almonds, olives, and oranges.

Practically all of these crops are grown under irrigation except some barley, almonds, and beans. And a goodly portion of these crops are in the southern portion of the basin, or the San Joaquin Valley, which is served by the San Joaquin River.

Up to now, this area has leaned largely on its ground water supplies for irrigation. But these supplies are being exhausted and, if it weren't for the mass movement of waters from the Sacra-

HEY HAVE PROTECTION A-PLENTY—Both e tomato plants near Yettem in the San oaquin Valley, with their weather caps, and e fields and livestock with their all-weather ater-guaranteeing canals like this one.➤

nento River, almost 500 miles away, to this land f the good earth, the very livelihood of many armers would be threatened. It might even have neant that the San Joaquin Valley would revert o desert.

But the Central Valley project has changed all hat. It has assured the San Joaquin Valley of a new and supplemental irrigation source. It has already supplied the farmlands of the Tulare area with surplus water from the Millerton Lake storage reservoir behind Friant Dam in Fresno County. And, beginning this summer, the Tulare area will be assured of a firm, guaranteed supply of water from the Friant-Kern Canal. THE END.

SUMMARY OF INITIAL FEATURES OF CVP

SHASTA DAM—World's second highest and second largest concrete dam. Height, 602 feet; length of crest 3,500 feet. Amount of concrete, 6,500,000 cubic yards.

SHASTA LAKE—Storage capacity 4,493,000 acre-feet; shoreline, 365 miles; length 35 miles; surface area, 29,000 acres. Depth of water at dam, 515 feet.

SHASTA POWER PLANT—Capacity 379,000 kilowatts; number of generating units, five of 75,000 kilowatt capacity, two of 2,000 kilowatt. Average operating head, 375 feet.

SHASTA-TRACY EAST SIDE TRANSMISSION LINE—Length 231 miles; voltage, 230,000; type of towers, 100 miles of wood pole, H-frame remainder single circuit steel towers.

KESWICK DAM—Afterbay for Shasta. Height, 159 feet; crest length, 1,046 feet; amount of concrete in structure, 200,000 cubic yards. Capacity of reservoir, 24,000 acre-feet.

KESWICK POWER PLANT—Generating capacity 75,000 kilowatts. Number of units, three of 25,000 kilowatts each.

DELTA-CROSS CHANNEL—Control gates, two 30 by 60 feet radial gates, capacity, 7,600 second-feet. Length of excavated channel, one mile; natural channels used, 49 miles.

CONTRA COSTA CANAL—Length, 48 miles; capacity, 350 cubic feet per second; number of pumping plants, six; total lift 250 feet.

TRACY PUMPING PLANT—Number of pumps, six of 22,500 horsepower each; capacity, 4,600 second feet; total lift, 197 feet; number of discharge lines, three of 15-foot inside diameter; source of water, Sacramento-San Joaquin Delta, fed by Delta Cross Channel; source of power for pumps, Shasta and Keswick power plants via Shasta-Tracy 230,000 volt line.

DELTA-MENDOTA CANAL—Length, 117 miles from Tracy pumping plant to Mendota pool; capacity, 4,600 second feet; width at top, 100 feet, with 45-foot bottom; depth 18 feet; concrete lined with exception of short section at southern end.

FRIANT DAM—Fifth largest concrete dam in world, height, 319 feet; crest length, 3,488 feet; volume in cubic yards of concrete, 2,135,000. Reservoir capacity, 520,000 acre-feet.

MADERA CANAL—Length, 37 miles from Friant Dam to Ash Slough; capacity, 1,000 cubic feet per second.

FRIANT-KERN CANAL—Length, 153 miles from Friant to Bakersfield; capacity, 5,000 second feet.

FROM DESOLATION AND DROUGHT such as that depicte at left, Central Valley project canals like the Madera Cana shown below have, are now, and will continue to rescu productive and potentially productive farm lands in th once water-deficient San Joaquin Valley of Californi

ONE HUNDRED YEARS OF IRRIGATION IN THE CENTRAL VALLEY, CALIFORNIA

by JAMES G. LINDLEY, Regional
Operation and Maintenance Supervisor,
Region 2, Sacramento, Calif.

FROM ALMOST ZERO in 1850 to more than 4 million acres in 1950, producing approximately 200 different commercial crops—that is the record progress made in developing irrigation in the Central Valley of California.

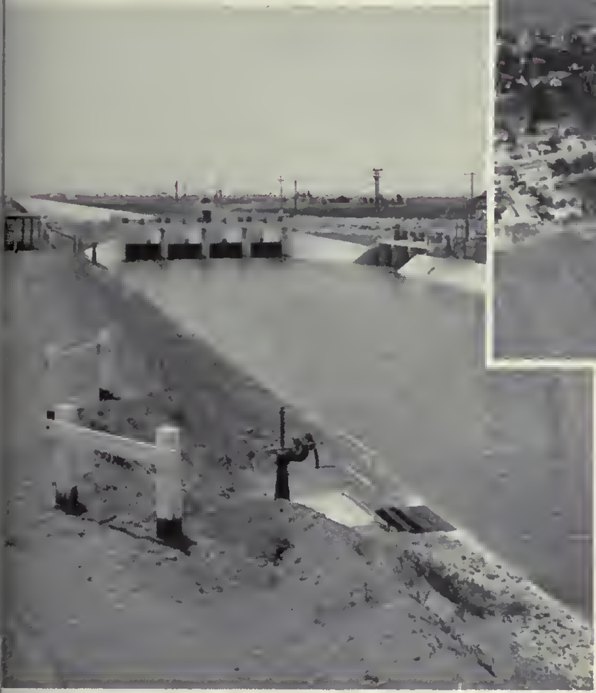
Although some water was diverted from local streams and some water from mining ditches was used prior to 1850, the first major canal constructed in the San Joaquin Valley was the Miller and Lux Canal in 1870 which reached from the great bend in the San Joaquin River northward to Newman. This canal later was extended to Crows Landing, and was used mainly for the production of forage on thousands of acres of easily accessible lands.

Soon afterward the Calloway Canal was con structed by the Kern County Land Co. This cana diverts water from the Kern River near Bakers field and serves many thousands of acres betwee the Kern River and Poso Creek. Like the Mille and Lux Canal to the north these waters were use largely for production of forage to supply cattl feed.

The success of the above mentioned canals i supplying water for irrigation encouraged man other diversions. The potentialities of irrigatio encouraged the planting of perennial crops such a alfalfa, trees, and vines. With the increase o permanent crops, firm supplies of irrigation wate were imperative.

Probably the most important milestone in irri gated agriculture in California was the passag of the Wright Act in 1887. This act permitte

O PROSPERITY AND PLENTY as exemplified by ie Delta Cross Channel at right which diverts acramento River water into the Tracy Pumping ant. This exchange of waters between two vers helps fill the Friant-Kern Canal below.



rrigation districts to levy assessments and issue onds to finance irrigation developments. Con-emporary to and immediately following the pas-age of the Wright Act a number of irrigation listricts such as the West Side, Modesto, Turlock, Alta, and Tulare Irrigation Districts in the San Joaquin Valley and Browns Valley Irrigation Dis-rict in the Sacramento Valley were formed in the ate 80's.

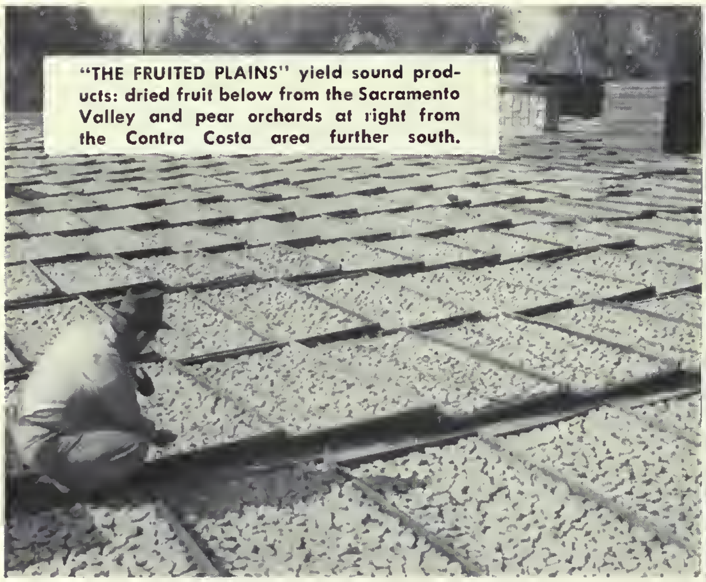
As irrigated crops increased, extensive develop-nent of agricultural handling and processing in-lustries such as commercial dairying, fruit hipping, canning and drying, wine making, and egetable handling and shipping industries soon ollowed.

In the period from 1900 to 1930 irrigation facili-ies were rapidly extended. In these 30 years more han 50 irrigation districts were formed. The empo of the growth of irrigation was increased y the high prices of agricultural products oc-asioned by World War I. During this period uch crops as cotton, sugar beets, rice, almonds, nd prunes became major crops in the Central Valley area. The development first of the cen-trifugal pump and later the turbine pump and the improvement in fuels permitted the expansion of irrigation into areas where water could be less easily diverted. An extensive citrus industry in the thermal belt area of eastern Fresno and Tulare Counties, fruit and field crop production on the fans of Cache and Putah Creeks all became possible because of the development of suitable irrigation pumps during this period.

Low farm prices of the 1930's caused an abandonment of some irrigated acreage in the Central Valley but the requirements for agricultural products brought on by world unrest since 1940 has occasioned a major increase in irrigated acreage. Deep pumping in western Fresno County for production of cotton, flax, alfalfa, and truck crops and the expansion of irrigation in the winter truck gardens of the Arvin-Edison area are two of the more pronounced developments occurring during the last few years.

Far-sighted individuals foresaw that the water supplies in the San Joaquin Valley were inadequate to supply the needs for irrigation of all of the lands. The State engineer's office started studies of land and water resources in the State as early as 1868. By 1930 the State engineer reported on the State Water Plan which had been under investigation for many years. One of the major features of this plan was to export water from the Sacramento Valley, which had an excess of water, to the San Joaquin Valley where there was a great deficit. The plan, known as the Central Valley Project Act, was submitted to the State

(Please turn to page 183)




"THE FRUITED PLAINS" yield sound products: dried fruit below from the Sacramento Valley and pear orchards at right from the Contra Costa area further south.

Central Valley Project— A Sound Investment

by THOMAS K. VASEY

Regional Programs and Finance Officer
Sacramento, Calif., headquarters for Region 2

THIRTY-FOUR MILLION DOLLARS, representing 9 percent of the Federal money invested in the Central Valley project to date has been returned to the United States Treasury through water and power sales. This healthy achievement was made with the project in partial operation only.

Of greater benefit than the money returned to the Treasury is the project's contribution to the total wealth of the Nation in increased agricultural and industrial production made possible by the availability of additional water and power.

Funds advanced by the United States Treasury on approval of Congress for construction, operation and maintenance of irrigation works and power facilities must be repaid from project revenue. Costs allocated to flood control and navigation, considered to be of benefit to all the people, are borne by the Government and not repaid.

A repayment analysis made for the initial features of the Central Valley project (House Document 146, 80th Cong., 1st sess.) indicated the required repayment could be made by the end of fiscal year 2005, or 60 years after the first project operation in fiscal year 1945.

The estimated cost of the American River Development, recently authorized by Congress as a part of the Central Valley project, will be repaid within the original payment period. The additional revenue from water and power sales assumed from the operation of this new portion of the project will make possible this repayment. A new repayment schedule prepared as a result of the American River development being authorized as a part of the Central Valley project indicates the final payout date the same as in House Document 146 and, in addition, it is estimated there will be $87,000,000 in power revenues accumulated over and above the required repayment.

Power, irrigation's paying partner, has been the principal source of revenue for the Central Valley project to date. Some municipal and industrial, and irrigation water revenue has been realized from deliveries through the Contra Costa Canal, the Madera Canal, and a portion of the Friant-Kern Canal. Water revenue will increase in succeeding years as the distribution systems for irrigation districts are completed and the main canal system of the project is placed in full opera-

on. The chart, "Central Valley Project, Sum-
iary of Operating Results" shows the high net
eturns realized from project operations.

Almost 90 percent of the total cost of the proj-
ect will be repaid to the United States Treasury
y revenues resulting from the sale of electrical
ower and water. Power revenues will eventually
ay for approximately 45 percent of the project
nd revenues from the sale of irrigation, municipal
nd industrial water, will pay for approximately
2 percent. The remaining 13 percent of the proj-
ct cost involves features incorporated in the proj-
ct for flood control, navigation, fish and wildlife
rotection, salinity repulsions, and recreational
ise. These latter costs represent a contribution
of the people of the United States to the national
velfare.

Fifty-six percent of the total estimated con-
struction costs of the authorized project have been
spent to date. This virtually completes many of
the initial backbone features and places the pro-
ject in partial operation. The remaining 44 per-
cent includes the cost of developments which have
been recently authorized by Congress for inclusion
in the over-all project such as the power develop-
ment on the American River (estimated cost $32,-
000,000), and Sacramento River Canals (estimated
cost $42,000,000). In addition to these two items
there remains a third, approximately $70,000,000
of additional distribution system construction.
This latter item results from requests by local ir-
rigation districts that the Bureau construct their
distribution systems. Contracts for repayment
of this expenditure will be made by the districts
prior to construction.

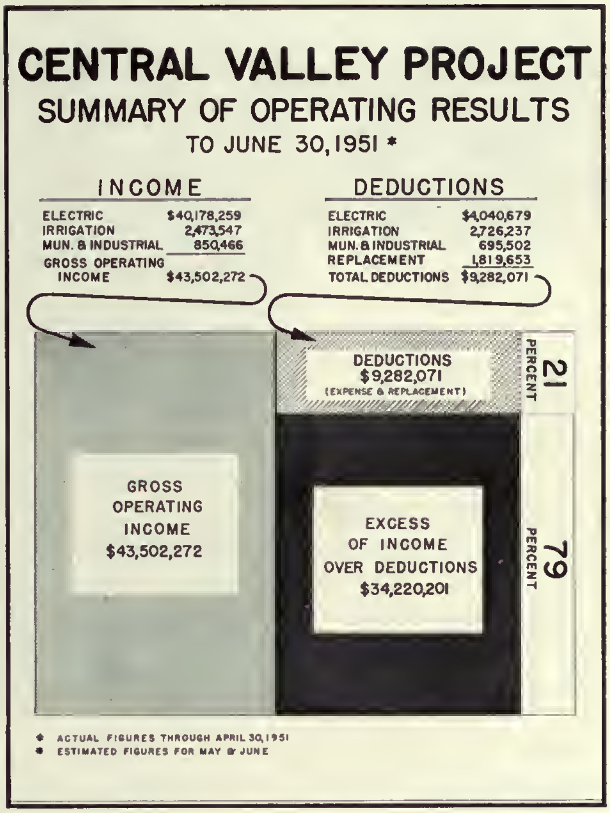
When all authorized features of the Central
Valley projects are completed, it is estimated they
will cost $625,300,000, of which approximately
$350,000,000 has been expended.

Construction progress to date has brought many
of the initial features of the project near com-
pletion. Fiscal Year 1951 construction costs ap-
proached $47,000,000.

The principal items of cost during fiscal year
1951 were $2,300,000 for dams and reservoirs;
$1,900,000 for the Tracy pumping plant; $22,-
500,000 for the canal system; $11,700,000 for the
power facilities; and $6,400,000 for the water dis-
tribution systems for irrigation districts. The
balance ($2,200,000) includes the cost of water
rights, utilities, housing and other related items.

THE END.

THE POINT OF HIGH RETURN has already been reached although the Central Valley project has only been in partial operation.



Kern County Officials Sign Recordable Contracts

Officials of Lanza Vineyards, Inc., and Billings Ranches, Inc., both located in Kern County, have signed contracts with the Bureau of Reclamation under which they agreed to dispose of land in excess of 160 irrigable acres, at prices determined by an appraisal board. Signing the contracts for the corporations involved were W. W. Owen and R. L. Billings, presidents of the respective land companies.

R. S. Calland, acting regional director of the Bureau of Reclamation, in announcing the action, pointed out that under Reclamation law, an owner can receive Central Valley project water for only 160 acres of his holdings, unless such a recordable contract is signed.

Lanza Vineyards agreed to dispose of 1,120 excess acres in the Southern San Joaquin municipal utility district, and 820 acres in Delano-Earlimart. Billings Ranches, Inc., have agreed to dispose of 160 excess acres in the Delano-Earlimart district. The contract allows the companies 10 years to conclude the sales. •

WELL WORTH CELEBRATING

by
WILLIAM M. CARAH
Sacramento, Calif.

THEN AS NOW—In 1949 the Orange Cove Lions threw a big shindig to celebrate receiving the first water from the Friant-Kern Canal.

Fifteen California communities are pushing to completion their plans for participating in the Central Valley Water Festival from August 1 to 10, marked the first full, integrated operation of the great Central Valley project.

Residents of the State's fabulous interior valley agricultural empire will celebrate the arrival of life-giving water with ceremonies, regattas, parades, aerial exhibitions, barbecues, and pageantry during its 10-day journey from Shasta Dam on the Sacramento River, to Bakersfield, terminus of the Friant-Kern Canal, nearly 500 miles to the south.

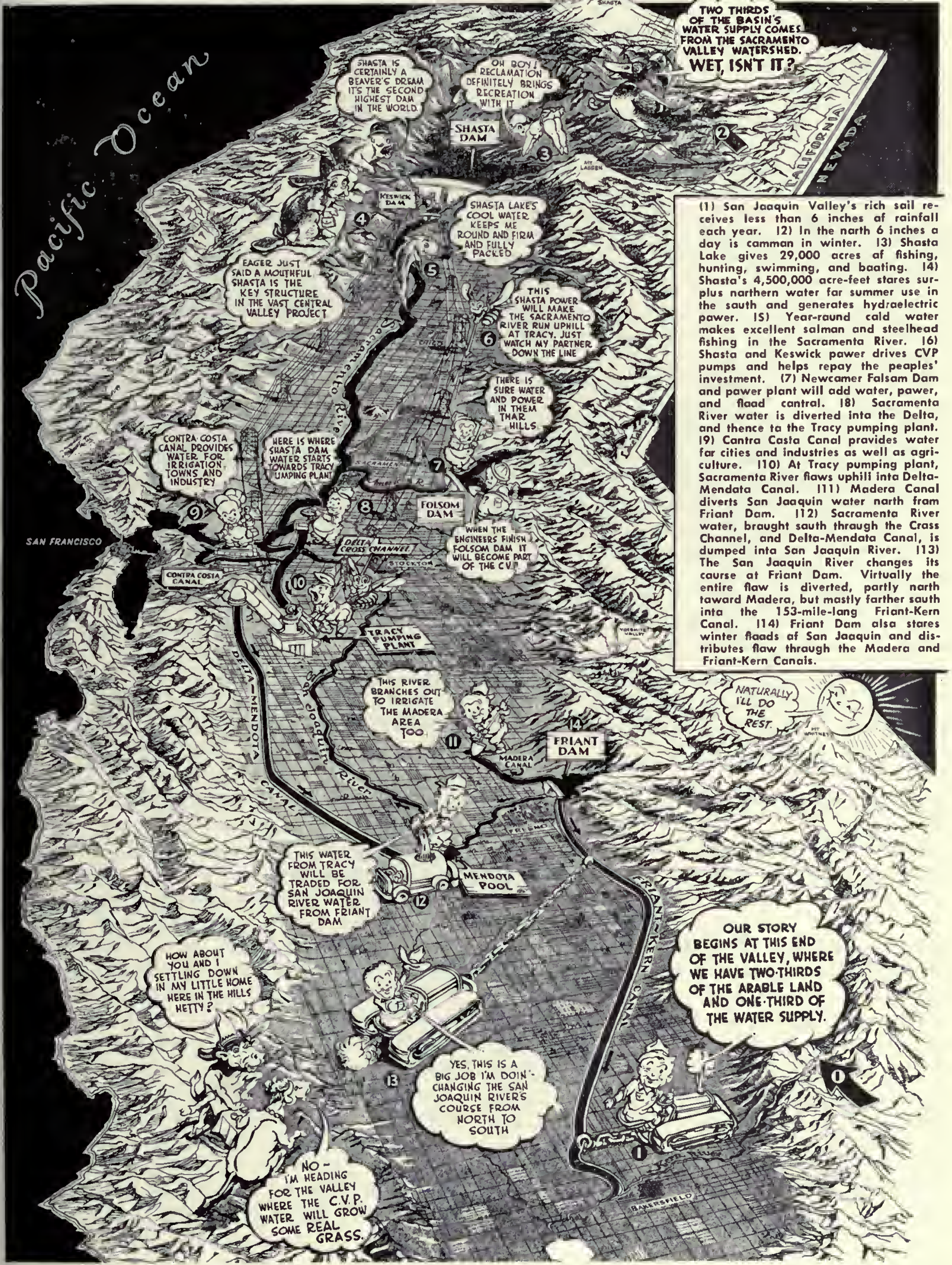
Just as CVP means many things to many communities, each one is planning an event highlighting a particular phase of the project as it affects a particular area.

But all of them revolve around the theme of water, which is more important to California today than was gold to the State a century ago. Agriculture is the State's major industry, and every member of the commonwealth is in some way affected by the rich production of its farm lands.

At Shasta Dam, the initial ceremonies on August 1, will dramatize the collection and storage of water from the streams of the water-surplus northern mountains, and the generation of a huge block of hydro-electricity energy at Shasta and Keswick power plants, to supply farms, homes, and industry of the State.

Ten miles downstream from Shasta lies the enterprising lumber and mining center of Redding, whose late leaders, John McColl and Francis Carr, worked tirelessly during the early days to make CVP a reality. On the evening of August 1, Redding will take cognizance of that part played in the project's development, and of its position at the head of the great Central Valley basin. Appropriately, the events will be held on the banks of the Sacramento River, which carries CVP water from Shasta to the southern end of the State. Highlighting this relationship, two of Redding's leading citizens will embark down the river by boat, carrying a cask of Shasta water to the dry farm lands of the south.

At Red Bluff, below the mouth of Iron Canyon, the river changes its character from a swift, turbulent mountain torrent to a placid, slow flowing stream. Here the terrain also makes a marked change. It is the real beginning of the great Central Valley, where a reliable water supply can mean the difference between life and death of agricultural growth. Then, on August 2, the people of Tehama, Glenn, Colusa, and Butte Counties, which form the upper tip of the valley, will



(1) San Joaquin Valley's rich soil receives less than 6 inches of rainfall each year. (2) In the north 6 inches a day is common in winter. (3) Shasta Lake gives 29,000 acres of fishing, hunting, swimming, and boating. (4) Shasta's 4,500,000 acre-feet stores surplus northern water for summer use in the south and generates hydroelectric power. (5) Year-round cold water makes excellent salmon and steelhead fishing in the Sacramento River. (6) Shasta and Keswick power drives CVP pumps and helps repay the peoples' investment. (7) Newcomer Folsom Dam and power plant will add water, power, and flood control. (8) Sacramento River water is diverted into the Delta, and thence to the Tracy pumping plant. (9) Contra Costa Canal provides water for cities and industries as well as agriculture. (10) At Tracy pumping plant, Sacramento River flows uphill into Delta-Mendota Canal. (11) Madera Canal diverts San Joaquin water north from Friant Dam. (12) Sacramento River water, brought south through the Cross Channel, and Delta-Mendota Canal, is dumped into San Joaquin River. (13) The San Joaquin River changes its course at Friant Dam. Virtually the entire flow is diverted, partly north toward Madera, but mostly farther south into the 153-mile-long Friant-Kern Canal. (14) Friant Dam also stores winter floods of San Joaquin and distributes flow through the Madera and Friant-Kern Canals.

be celebrating the passage in Congress of the latest addition to CVP—a series of irrigation canals, diverting from the Sacramento at Red Bluff, and serving 200,000 acres in their areas. (See article entitled, "Canals for Sacramento Valley," page 138, July 1951 issue).

Farther down the river, in the heart of the Sacramento Valley, another big river, on whose banks gold was discovered in 1848, now brings to the Central Valley basin riches in a different form. At the confluence of the American River and the Sacramento, lies the State Capital of Sacramento, also once dependent on gold, but now the center of a great agricultural area depending on water. This thriving city will be the scene of the events of August 3, marking arrival of CVP water and the addition of the Folsom Dam and power plant to the project.

Meanwhile, a series of related events will be leading up to the central ceremony of the Central Valley Water Festival at Tracy pumping plant. The city of Tracy, near which the 135,000 horsepower pumping plant will lift Sacramento River water into the Delta-Mendota Canal and thence into the San Joaquin Valley, will start its 3-day celebration. On the morning of August 4, the Port of Stockton will play host.

At 2 p. m. on August 4, a button will be pressed, sending power from Shasta and Keswick Dams into the six 22,500 horsepower motors of the Tracy pumping plant, lifting CVP water into the Delta-Mendota Canal, and placing CVP into full operation. From Tracy south, the project and the celebration enters a new phase—that of placing the water on the land.

Los Banos, located in the rich east side of the San Joaquin Valley, is in the center of the farm area through which the Delta-Mendota Canal passes, en route south, delivering some of its water along the way, but transporting the bulk of it to the Mendota pool on the San Joaquin River 120 miles distant from the pumping plant. Citizens of this area will mark arrival of CVP water with ceremonies on August 6.

At Friant, on the San Joaquin River northeast of Fresno, the great concrete Friant dam spans the river canyon. Here the waters of the stream are turned south into the great Friant-Kern Canal, from which they are turned on to the rich lands of the San Joaquin Valley, with its billion dollar crops and 3,500,000 cultivated acres.

Joining in the celebration to be held on the shores of Millerton Lake behind Friant will be communities, organizations and individuals from the rich area served by the Madera and upper Friant-Kern Canal.

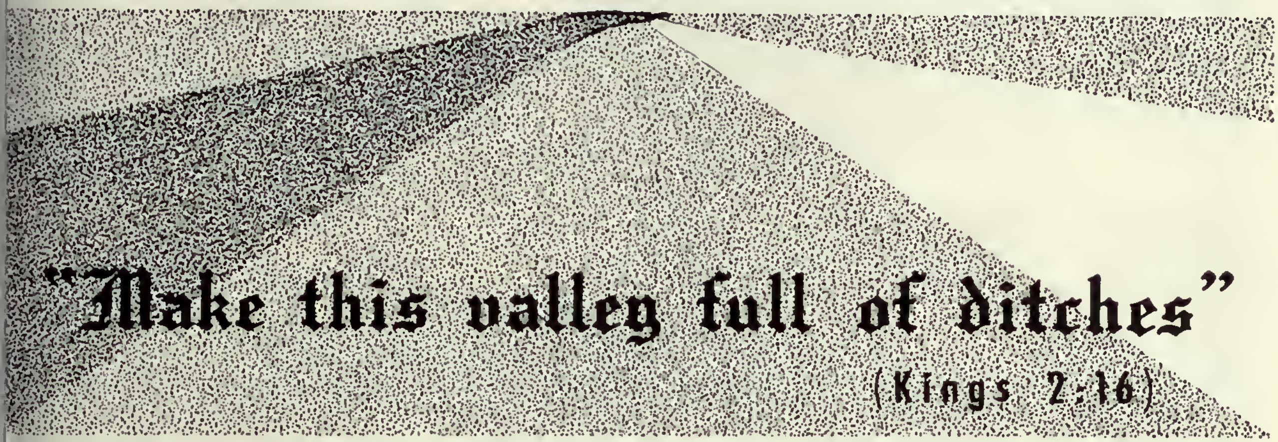
At Friant, CVP canals run both north and south. From the east abutment of the dam, the Madera Canal meanders north 37 miles to Ash Slough, which runs through the Madera and Chowchilla areas. From the west side of massive Friant, the Friant-Kern Canal runs south, 153 miles through some of the valley's richest land to the Kern River near Bakersfield. At Chowchilla, not far from the spot where the Madera Canal empties into Ash Slough, directors of the Chowchilla water district are planning an observance on August 8 highlighting benefits from Millerton Lake.

As it carries its load of life-giving water down the valley, the Friant-Kern passes through the rich and highly developed citrus and olive belt centering around Lindsay. Here, in the words of a veteran newspaper editor of Lindsay, CVP water arrived just in time to prevent the loss of thousands of acres of valuable orchards. Already arrival of the water has been felt by the area's economy. Thus, also on August 8, the communities of Lindsay and Orange Cove will mark the arrival of CVP water and celebrate its benefits, present and future.

Past Lindsay, the canal leaves the foothills and flows across the flat lands of the rich cotton and potato land of northern Kern County, and finally to the Kern River west of Bakersfield. Last outlet along the canal for CVP water is in the Southern San Joaquin municipal utility district, which has its headquarters near Delano. This community has planned an observance on August 9.

Bakersfield is the metropolis of the southern San Joaquin, deriving its growth and livelihood from oil and agriculture. It is a center for the great new cotton economy of California, and for a vast potato growing and processing area. Dozens of other crops from grapes to alfalfa also contribute to Kern County's agricultural prosperity, to which water is of the greatest importance. There, on August 10, will be the fitting climax to the Central Valley Water Festival. On the banks of the Kern River, where the canal terminates, will be the fourth and last major observance of the 10-day celebration as water from Shasta Dam, 500 miles to the north, is spilled into the utmost reach of the "push-button" waterway. THE END.

THE SAGA OF CENTRAL VALLEY



by MICHAEL W. STRAUS

Commissioner of the Bureau of Reclamation

Long before the birth of Christ, a wise man named Elisha, who lived in a land dry as the Central Valley, spoke these words:

> . . . Thus saith the Lord, make this valley full of ditches.
>
> . . . for ye shall not see wind, neither shall ye see rain; yet that valley shall be filled with water, that ye may drink; both ye, and your cattle, and your beasts.

Elisha, the prophet, knew that man could not long dwell in an arid land unless he irrigated the soil.

And today, in this age of scientific marvels, we have reached back to the dawn of civilization for the simple truth that has enabled California to become one of the most prosperous States in the world's richest Nation.

For a century of experience, some of it black and bitter, has taught that the irrigation ditch is the symbol of security and prosperity in this land of normal drought.

After the great cattle empires had arisen and fallen; when the wealth of the vast wheat fields had vanished in a cloud of dust from the exhausted earth; and the army of the gold miners had dwindled to a corporal's guard—California knew that in her arid Central Valley lasting prosperity could exist only amid green irrigated fields and orchards.

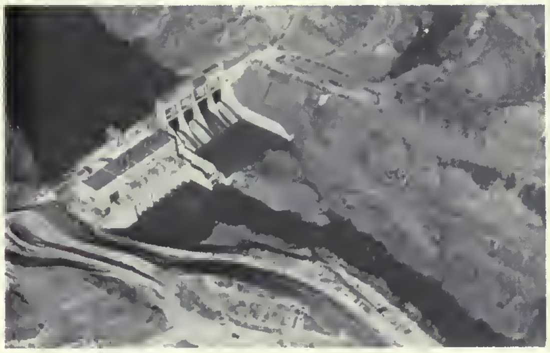
So, today, we mark triumph of the irrigation ditch over the desert.

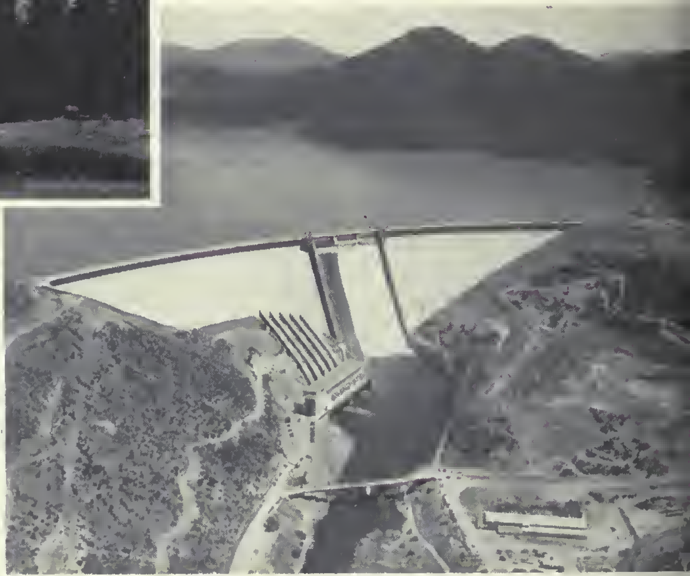
California, at last, can make the Central Valley full of ditches. These ditches will keep the homes of her 10,000,000 people of today, and her 20,000,000 people of tomorrow, secure and filled with good living.

The first mass movement of irrigation water throughout the entire length of this Valley, the first surge of the water, marks the beginning of full-scale operation of your Central Valley reclamation project. And, through the operation of this project—as one single, complete and integrated system for regulating the rivers, conserving and transporting water to serve the entire valley, you can have enough water for your fields, for your rapidly growing urban communities, and your expanding industries.

And, you can have the hydroelectric power, the

FROM SNOW-CAPPED SHASTA melting snows on the mou
tain peaks are caught and held behind Shasta Dam belo
the key unit of California's Central Valley project.
lower left, Keswick Dam, the afterbay for Shasta, hel
reregulate the Sacramento River and produce hydro pow
At the bottom of the page, at left, the Tracy pumping pl
lifts Sacramento River water into the lower valley to t
south to fill canals like the Delta Mendota at lower rig





protection from floods, and from encroachment of the sea, and the many other benefits of multiple-purpose Reclamation development.

As you progress and grow, and as this project is expanded to provide more water and power for that growth, you can literally make the valley full of ditches. For you shall have water to fill them!

To provide you with this water and the other benefits it has been necessary to build one of the world's greatest and most spectacular water r sources projects.

By exchanging conserved and regulated flo of the Sacramento and San Joaquin Rivers, th project will move water virtually 500 mil stretching from Shasta Dam, in the north, to b low Bakersfield in the south. That is the longe movement of irrigation water man has ev attempted.

This day will open a new epoch in the prosperity of your State, one that will directly benefit your own lives, and bring a fuller measure of good living and security to the entire United States. The eyes of the whole world are upon you, as this project also demonstrates to hungry peoples all over this crowded earth, that better living and security can be found in well-planned, soundly conceived development of natural resources, under our democratic form of government.

So, as the water progresses southward, throughout the vast project system that links rivers to river-sized canals, with Shasta's and Keswick's power plants, a network of transmission lines and Tracy's big pumps to boost it along the way, Californians will celebrate.

TO THE TIP OF THE SAN JOAQUIN water is transported through huge siphons (like the one above along the Delta Mendota Canal) and canals like the Friant Kern directly above, for multiple purposes, not the least of which is recreation. At left, an angler tries his luck in the clear cold water of Shasta Lake.

The celebrations emphasize, louder than words, how tightly the future of this entire valley, with its 1,500,000 people, living on its 60,000 farms or in its 83 cities and towns, is tied to this project. Your security and prosperity will be measured directly by the success of its operation. Your growth, and the future opportunities for your children and their children, will be molded by how well this project and its future units perform their functions for generations to come.

Some Californians were aware, as long ago as 1850, that the road to permanent prosperity lay over the irrigation ditches that would have to gird this valley. Some knew, as early as 1860, that major irrigation works, with great backbone canals, would be required. And that was long before anyone ever realized that the valley, a century later, would have become one of the Nation's most highly developed agricultural and industrial areas. Or that its farms would grow more crops than New England, its plants ship their wares all over the United States, and its people would buy merchandise ordered from all parts of the country.

The State's first legislature passed a law, in 1850, directing the surveyor general to develop a master water-resources plan, embracing irrigation, drainage and navigation, and encompassing both the Sacramento and San Joaquin Rivers. But the


THE NATION GAINS when California buys more than $11,000,000,000 worth of goods, benefiting manufacturers, wholesalers, and retailers all over the U. S. A.
$11,280,486,000
AS THE PROJECT GROWS it sets up a chain reaction of prosperity. Workers, manufacturers, and contractors have already received $99,000,000 worth of orders for the things that have gone into the construction of the Central Valley project.
$99,549,655
AND CALIFORNIA BUYS almost as much as the whole world buys from the U. S. A.—foreign exports amounted to $12,000,000,000 in 1949.
CEMENT
SHASTA DAM
KESWICK DAM
FOLSOM
Sacramento River
DELTA CROSS CHANNEL
CONTRA COSTA CANAL

legislature didn't give him any money to do the job, and most people soon forgot all about it in the mad, fabulous rush to strip the stream beds and the hills of gold.

It has been a long, rugged road, from that day to this. Californians have fought the lack of ditches and the shortage of water year by year, every foot of the way. One of the marvels of our time is how the people of California have achieved this great and expanding economy despite an insecure water supply.

But the need for firm water supplies, and a valley full of ditches, haunted those brave pioneers all along the way. Voices crying for more water, and for longer, wider, deeper, fuller, and more numerous ditches, and for more farms and homes for a growing people were heard louder and louder with each passing generation.

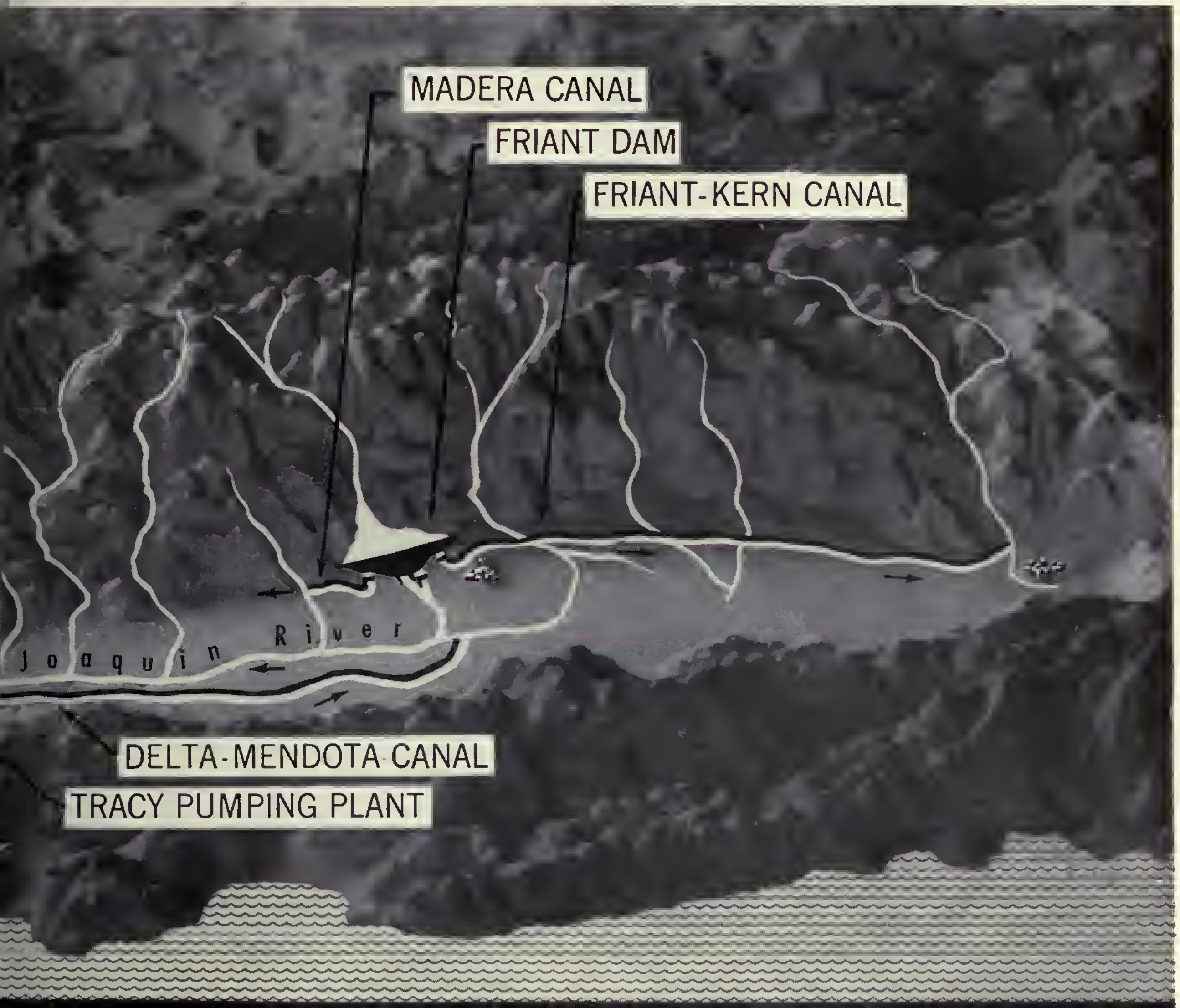
When the covered wagons wheeled their weary, dusty way into this valley, they found great seas of wheat, as the cattle empires of the grand seigneurs gave way to the realms of grain. There was no other wheat country like it. The endless fields

"THAT SEES BEYOND THE YEARS" this line from "America, the Beautiful" typifies the late Col. Robert Bradford Marshall, considered the real father of the CVP who first dreamed of harnessing the Central Valley streams and spreading their life-giving waters over the thirsty acres by a network of canals. He worked so devotedly at promoting his plan, called "The Marshall Plan," that he lost his voice, but he said, "Even though I knew it would cost me my voice, I'd do it again. I am only one man, but millions of people will benefit from this project."

spread, farther and farther over the valley—great empires built on golden grain.

The seemingly unending flow of fine hard wheat poured into markets round the globe—Great Britain, China, Mexico, South America, and even to Australia, where the farmers had deserted their wheat fields for the gold fields below the Equator.

So the Central Valley became the abode of the wheat kings—who were heedless to Elisha's com-



mand to make the valley full of ditches. And the land grew weary of one crop, year after year. The impoverished soil blew away or was covered and poisoned by the gold miners' "slickens." Sludge from the great barrages of water washing away at the foothills in quest of gold filled up the rivers and drove them further from their banks, and the time came when grain could no longer be grown in the Central Valley with profit.

But out of the exhausted grain fields and the muck-covered valley floor there arose, like the phoenix of ancient fable, new life from the green, irrigated fields that began to reach back from the banks of the streams.

Irrigation began feebly and grew haltingly. And it began to grow in the same monopolistic tradition as the epoch of wheat. Big landowners built their canals and fought bitter legal battles, between themselves and with placers, over rights to use of the water. Large water companies grew up as more capital poured into the new irrigation systems.

But in the Sacramento Valley there was one man among the wheat kings who knew that the march of time would soon catch up in California—that the day would come when men and women seeking their own small farms to raise their families could no longer be denied. Perhaps he knew that day would grow nearer as the ditches reached out from the rivers to make possible the small farms that now stretch out over the landscape.

The man was Joe Cone, who held a rich empire along the Sacramento. As early as 1890 he began subdividing his holdings. He even built a small power plant on Antelope Creek—to light his home and barn and to provide the first electric energy for other homes and families at Red Bluff.

Joe Cone, by his actions, was a prophet.

And there were some who harkened to the words of Elisha—and spoke with a voice steadily growing stronger—that the valley must be made full of ditches.

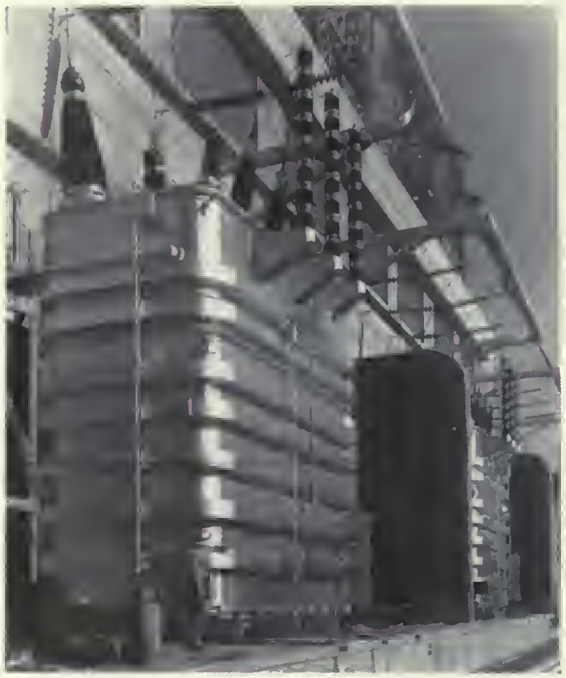
They were first heard in the Nation's capital in 1873. Congress authorized the study of irrigation development for the Central Valley and Col. B. S. Alexander of the War Department, a year later, submitted the first comprehensive plan for full use of the valley's water resources.

Where men had previously talked of great canals, running from South to North, tapping water sources of the San Joaquin River, Colonel Alexander found that the major source of the available water lay to the north—in the snow clad mountains flanking the Sacramento.

He laid down a plan, in strategy, if not in detail, similar to that of the Central Valley project whose waters are unleashed today.

But his was only the first feeble step. A few years later, the State Constitutional Convention ordered the planning of a State-wide water resources system. And that convention declared

FOR THE POWER to help pay for the project, to light the homes, farms, and cities, to turn the wheels of industry, to pump the water into the fields belongs to the people. Keswick power plant at left, is one which has already proved its worth. And with the power and the water, the people produce fabulous crops, like the bales of cotton shown below.



ND THE GLORY of richly yielding fields, flourishing forms, and osperous people depends upon fairly distributed water. Sacro-ento Valley may some doy be full of ditches ond green from othill to foothill—now the fields, like the one at right top, ore rrow green strips olong the river. And Fresno, where corn being cultivoted in the other photo, now has one of the biggest ches of all—river-sized Friont Kern Canal, in which is mixed ny waters—from nearby lokes ond far-owoy streoms.

ainst land monopoly and even talked about mily-sized farms, foreshadowing the present-y Reclamation laws and the Federal Reclama-on policy—which is in full accord with the State California and sprang from a proclamation in e Homestead Act of a most distinguished Re-ublican, Abraham Lincoln.

From these beginnings, there slowly emerged e outlines of what was to become today's Central alley project. Col. Robert Bradford Marshall, hief Geographer of the Geological Survey, orked tirelessly to bring the problem to public nderstanding—and worked out a plan for a great stem of dams, canals and other works that en-sioned today's development. His plan, made ublic in 1919, was placed before the California egislature in 1921. (He was nominated to eclamation's Hall of Fame in the January 1950 sue of the RECLAMATION ERA.)

California's own Ed Hyatt, another of the out-anding men of Western water resources devel-pment, worked tirelessly and effectively in fur-er molding the water development, until the day, 1931, when the "State water plan," the imme-iate forerunner of this project, received the ap-roval of the legislature and the people of the tate.

By that time, the growth of the Central Valley ad far outstripped its safe developed water sup-ly, particularly in the San Joaquin Valley. The alley had not been made full of ditches, nor had dequate supplies of water been made available. Vhen the unconserved and unregulated natural lows of the streams had all been put to use, men ug and drilled into the earth to pump out water or their ever-spreading irrigated fields. And the vater was pumped from the ground faster than ature could replenish it.

The valley soon learned, from sad experience, he simple truth that security and prosperity ould be won only by building dams to conserve he waters of the rivers, and great canals, pumps, ower plants, and transmission lines to transport he water where it was needed, all working to-ether as one great central system.

Until that was done, the valley could grow no more, and the desert would reclaim much of its present growth.

Your State then came to Uncle Sam for help. And the Federal Government's answer was President Franklin D. Roosevelt's approval of the Central Valley project in 1935, and an allocation of funds to get started. Engineers began the job of preparing construction designs and blueprints—a major task in its own right. The first earth was turned in 1937.

In August 1940, the first water was available in the Contra Costa Canal. Power surged over the lines, from the first of Shasta's huge generators in 1944. Except for vitally needed power features, construction was all but suspended during World War II, but once the shooting stopped, the work again went forward. In the meantime, the public was already receiving large benefits from operation of the features that had been placed in service.

Power from Shasta helped the Nation speed victory during the war—and the great generators there at Keswick have since helped California through a period of phenomenal growth.

Shasta and Friant have saved millions of dollars that would have been lost, otherwise, through the floods they have helped to reduce—though the valley is yet a long way off from complete flood protection.

Encroachment of salt water from San Francisco Bay has been stopped.

The Contra Costa and Madera Canals have brought relief from drought in the localities they serve.

You have the assured protection of the Reclamation laws in the widest distribution of irrigation water to the public.

The works now going into project-wide service for the first time will provide additional water for a half million acres of rich lands, heretofore inadequately supplied with water. They will provide water to bring another half million acres of dry lands under irrigation, to provide new family-farm opportunities for your growing population.

But this is just the beginning. Proposals for further expansion to meet future growth have been placed before the Congress with the sanction of President Truman. These proposed works would provide water for 1,200,000 acres more lands for new and supplemental irrigation, over and above the present project acreage. The power plants of these proposed works could provide an additional 113,000 kilowatts of generating capacity.

Looking even beyond these projected works, the people of California will have the basic network of water resources facilities which can be expanded to enable them to put the last drop of Central Valley water to work, when the day comes that they will need it.

So let us heed the words of the prophet Elisha—to go forth and make the valley full of ditches with the firm assurance that the water will be ready to supply the needs of the people.

For there are rocks to be smitten for other waters to gush forth, even as Moses did for the children of Israel—when the streams of the Central Valley are working full-time and the day comes when more water must be found—that the valley may flourish and its people may prosper.

THE END.

"YET THAT VALLEY SHALL BE FILLED WITH WATER" and two valleys shall be as one, each with its ditches flowing full, its fields rich and green, its cattle and beasts of the field well fed, and its people blessed with the good things of the earth. And the San Joaquin Valley, shown below, with its rich groves of oranges and grapes, is only a sample of what the future will bring.

RECREATION in the Central Valley Project

WHERE NO LAKE EXISTED before the advent of the Central Valley project, yachts rock at anchor as the sun sets over Millerton Lake, a man-made haven of rest created by Friant Dam in California.

/ E. A. PESONEN, Administrative Officer,
egion 2, Sacramento, Calif.

OVER A MILLION PEOPLE visited Shasta and riant Dams under construction until gasoline raoning intervened in November 1942. They were ostly sightseers out to enjoy America and to see s wonders, natural and man-made. Most of em simply tried to comprehend the immensity of e undertaking and to sense the long-range ecoomic values of the project. But there were hers who visioned also something more direct, ore imminent and more personal—recreation on e reservoir! Hundreds of people asked about bin sites, resort locations, boating faciilties, and shing opportunities on both Shasta and Millern (Friant) Reservoirs.

Captains and corporals wrote from the far corers of the earth hoping to establish a small resort isiness or build a restful cabin away from the ires of the world. A few tempered their enthusism with caution. They saw a reservoir, rather ian a lake, a reservoir of diminishing proportions s the summer progressed, especially in dry years. hey asked, "What will the drawdown be?" and When will it occur?"

Under the leadership of the National Park Service, a committee of representatives from 20 Federal, State, and county agencies prepared a report on the recreational potentialities. Those who would like to obtain more information on the subject might write to the Superintendent of Documents, Government Printing Office, for a copy of this report, entitled, "Problem 23, Central Valley Project Studies, Recreational Administration, May 1944."

Millerton Lake, lying in sparsely wooded foothills 20 miles northeast of Fresno, subject to a relentless summer sun and a drawdown of as much as 60 feet by the end of August, promised less ideal conditions for recreation. But with easy accessibility and a setting of verdant hillsides, the realization has exceeded the promise. As Millerton became the only sizeable lake within an hour's drive of more than 200,000 people, boats appeared by the hundreds as soon as the lake was opened to the public. Docks, a yacht harbor, picnic areas and sanitary facilities have been built. Community organizations have joined in planting hundreds of trees. Thousands who man the farms and shops of the busy valley have found a restful place for Sunday picnics, an evening swim, a few hours' fishing, a quiet day's sailing, or a spin in a motor boat.

Using electric eye counters at the gates, the National Park Service, which manages the Millerton Lake area, reports the following use—415,000 visitor-days in 1949 and 475,000 in 1950—figures greater than those for many National parks.

Shasta Lake, reaching 35 miles back into the rugged canyons of the Pit, McCloud, and Sacramento Rivers and Squaw Creek, lies like a four-fingered claw on the map. Only by boat can you reach most of its 365 miles of shoreline. Its huge volume (4,500,000 acre-feet) makes it a more stable body of water than Millerton, the drawdown being influenced not only by annual demands but by carryover storage from wet to dry years. Like Millerton, it is most attractive in the spring. Then the lake is full and the red bud, buckeye, wild lilac, and western azalea glorify the mountainsides. Toward evening when the sun first hides behind the higher hills and the wind dies down, deer come out to graze near the water—except during the hunting season. Sometimes a black bear is heard crashing through the brush. Cormorants roost impassively in dead trees, wood ducks flap away as a boat approaches, occasionally a fish hawk swoops on an unsuspecting bass. Shasta is a wilderness lake.

Camping in bays accessible only by water, trolling for the elusive kamloops trout, casting for black bass, enjoying the peace of a cabin on some wooded north slope, or just taking a long boat ride to view the water and the rugged landscape—these are the recreational attractions of Shasta Lake.

Although the dams and reservoirs are the principal recreational attractions created by the Central Valley project, mention should also be made of the rivers. The San Joaquin, with nearly all the flow impounded by Friant Dam, will be replenished by Sacramento river water delivered to it at the Mendota pool via the Delta-Mendota canal. The Sacramento has already been improved. The large flows released from Shasta Dam in summer and the decreased flood hazard in winter have encouraged boating while the sustained releases coupled with lower water temperatures have made the river a trout and salmon stream for a hundred miles.

Integrated operation of the Central Valley project has just begun but recreation is already an important function of this vast multiple-purpose project. The vision of the citizens who saw it under construction and the findings of the committee which verified that vision have been fulfilled. THE END

SPORTSMEN DELIGHT in such recreational pursuits as (1) catching bass from Millerton Lake, (2) spending a Sunday boating at Millerton, or (3) looking forward to the day when kamloops may be caught at Shasta. Here 25,450 of these fast-growing trout are being planted to provide the ultimate in "sporty" fishing.

KING COTTON and THE DROUGHT

LLOYD B. SHINN, San Joaquin Valley District
esno, Calif., Region 2
adquarters at Sacramento, Calif.

HOW DRY THE SOIL—Jack Locke sifts San Joaquin Valley soil through his fingers. It almost fades away in the wind.

THERE IS EVERY INDICATION that California's n Joaquin Valley will produce the biggest crop cotton in its history in 1951. Plantings are imated to be 1,200,000 acres for the entire State th San Joaquin Valley plantings representing 57,000 acres, more than 96 percent of the State's duction. Other plantings are principally in Imperial Valley.

The California average yield for the past 10 rs has been 600 pounds per acre. Assuming s yield for 1951, the production of cotton in lifornia will be approximately 1,500,000 bales, ving California up to third and possibly secd position in national production of cotton. e 5 year 1946–50 average yield is 668 pounds per re, however.

The 1950 yield was a phenomenal world record gh of 823 pounds per acre which came about rough a series of circumstances, the most promint of which was the national and State curtailnt of cotton acreage, causing growers to plant ly their best lands to this best cash crop. Probly the next greatest influence in producing this ghest yield was the very favorable growing son. Another prominent factor in producing e excellent yield was the statewide use of the new cellent cotton variety, Acala 4–42. This new riety has proved to be a high yielding, highsile-strength cotton in great demand by the lls.

In 1951 with no curtailment of acreage by a tional cotton allotment program, and a price arantee of about 30 cents per pound (90 percent parity), the planting of cotton in the San Joain Valley of California has been limited only by e availability of irrigation water.

To take care of the expected increase in cotton oduction in the Valley, an additional 40 gins e being built to augment the 150 which are aldy on hand. During the last 3 years, a good are of the cotton has been picked by mechanical cotton pickers which numbered 1,200 in 1950. It is estimated that the increase in mechanical cotton pickers in 1951 will be limited to 600 because of the emergency program. The supply of labor appears adequate and most farmers are well equipped with tractors and cultivation and harvesting equipment to handle their farming operations.

In the face of all of these conditions favoring cotton farmers and other California farmers in the San Joaquin Valley is the menacing shadow cast by the seventh successive year of water shortage. Irrigation pumps and wells are being taxed to their utmost to supply water from increasingly greater depths. In numerous cases wells have been drilled to the lowest possible depths with only a temporary betterment of water supplies.

In 1948 in an east side area of ground-water measurement south of the Kings River service area (including parts of Fresno, Tulare, Kings, and Kern Counties) and continuing south to within 15 miles of the Ventura County line there had been pumped from the ground-water storage more than 1,100,000 acre-feet in excess of the natural inflow. This means that during 1948 this amount of water was used for agriculture in the area in excess of inflow to underground storage.

Much new land has come under irrigation since 1948, so that the overdraft on ground-water supplies in the area approaches 1,500,000 acre-feet in 1951. Beginning in 1945, inflow to ground-water reservoirs has been below normal because of insufficient runoff from watersheds in the Sierra Nevada Mountains to the east. Normal runoff is based upon a 45-year (long term) average.

The last year of normal or above normal runoff was 1944–45 when it was 32 percent above long-term or normal figures for the area. Since then runoff has been as follows: 1945–46, 86 percent of normal; 1946–47, 72 percent of normal; 1947–48, 50 percent of normal; 1948–49 50 percent of normal; 1949–50, 68 percent of normal; and 1950–51, approximately 55 percent of normal.

The cumulative effect of these years of below normal runoff or inflow to ground-water reservoirs, in conjunction with the greatly increased drain on pump-water reserves because of expanded acreage of cotton and other crops, has created a serious ground-water deficiency.

To alleviate this water shortage, deliveries of water from the Friant-Kern Canal began in 1949, and since that time have increased generally in line with completion of distribution systems for individual water user districts.

In addition to deliveries along the Friant-Kern Canal, water has been delivered in substantial amounts to the Madera irrigation district an Chowchilla water district from the Madera Cana and also to temporary water service contractor along the San Joaquin River.

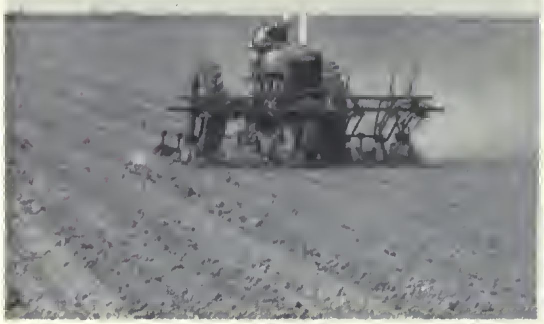
Total diversions of water from Friant Dam t long and short-term contractors in 1950 amounte to 450,000 acre-feet and will total approximatel the same in 1951. Availability of water fro Friant Dam has been the direct cause of ne acreage being brought under irrigation in th Friant-Kern and Madera Canal service areas an has been a source of supplemental water of con siderably more acreage in these areas. This ne acreage, brought into production since the sta of the 1949 irrigation season, has amounted t 32,000 acres. Lands given supplemental wate will probably amount to 466,000 acres in 1951.

Value of crops raised on the new acreage i 1949 amounted to $1,849,000; in 1950, $3,259,00 and in 1951, it is estimated that the value wi total $7,500,000.

Gross crop income from acreage given supple mental water in 1949 amounted to $45,468,000; i 1950, it amounted to $98,328,000; and in 1951, i should amount to $110,000,000.

The importance of cotton in these areas recei ing supplemental water from Friant Dam i shown by the fact that more than 126,000 acr were grown in 1950 with a gross farm value o $39,000,000. This represents over 20 percent o the entire California cotton acreage grown i 1950. The En

HOW WELCOME THE WATER—At left, Locke cleans mud fro pipe outlet leading to irrigated cotton row. "Milky" water is d to chemicals, added to help penetration of "hardpan" strata. lower left, cultivating cotton on land owned by A. Perelli-Mine & Sons about 2 miles north of the town of McFarland. Belo seeding cotton on the Hartman Corp. land about 4 miles southea of Delano. This land borders on the great Friant-Kern Cana



"FOR PATRIOT'S DREAM"—The family-sized farms in the San Joaquin Valley near Fresno typify the long-awaited dream-come-true made possible by the Central Valley project whose features are being explained at left by the author to a group of visiting dignitaries.

The Central Valley Project—

TAKING INVENTORY

y RICHARD L. BOKE,

egional Director, Region 2,
leadquarters at Sacramento, California

Although completion and first full opera-ion of the Central Valley project's initial fea-ures represents an engineering feat of the greatest nagnitude, and a major milestone in the history f water development, this event is but a way point n the Nation's efforts to bring to its people the argest possible beneficial use of its natural re-ources.

Much of the history of CVP has been the story f a struggle between the forces which set forth o implement this policy of fullest benefit to the greatest number of people, and those who would ake these benefits for themselves, or thwart the ublic aims of the project.

The record is not only one of obstacles and de-ays, it is also one of great progress made in spite f these obstacles.

Huge amounts of irrigation water are being stored behind Shasta Dam, and are being delivered through river channels and man-made canals to the farm lands of the dry, but phenomenally rich San Joaquin Valley.

Public power is being generated at both Shasta and Keswick power plants, and is being transmitted over publicly owned and operated lines.

The CVP has been recognized by the Congress as a growing development, not a static project, by the successive addition of the American River division and the Sacramento Valley canals as authorized features.

Water contracts have been executed with 15 California irrigation or public utility districts, and negotiations are underway to bring CVP water to many others. All of these contracts are under terms of Reclamation Law, embracing the acreage limitation on project water delivery. Recordable contracts calling for disposition of excess lands have been signed, and more are on the way.

These contracts represent significant victories in the continuing fight not only to bring water to the land, but to distribute its benefits as widely as possible consistent with the letter and spirit of Reclamation Law.

Although the acreage limitation has become a less embattled issue with the execution of these contracts, those who would have the project operated outside the Reclamation Law have been unremitting in their attacks. Presently the arena of battle is in the superior courts of the project service area's counties. In each case, before the contracts between an irrigation district and the Bureau of Reclamation become effective, court validation is necessary.

Another perennial maneuver concerns the operation of the project. An interesting observation in connection with these attempts is that proposals to have the State of California take over and operate the project are being pushed by much the same group which killed an earlier attempt to place CVP in the hands of the State for operation and maintenance. Thus it appears reasonably certain that the State vs. Federal control is not the real issue.

The doctrine of State or local operation neglects some elementary but important financial and political facts. All Federal reclamation projects, including the Central Valley project, have been developed by a direct Federal investment of funds appropriated by the Congress. The Government assumes the total cost of flood control, navigation, fish and wildlife preservation and conservation, recreation and other contributing benefits. Since the Central Valley project serves these major purposes, plus irrigation and power, the cost of water to the user is substantially reduced. Only power and irrigation costs are repaid to the Federal Government. Furthermore, Federal funds advanced for irrigation bear no interest.

Financial support for irrigation on this project, as on other great multiple purpose works, is available through the sale of project power, which makes it possible to deliver cheap irrigation water. Thus the thousands of irrigation farmers and the millions of electric power users have a huge stake in seeing that the project is operated in such a manner that these power benefits are equitably distributed.

The peoples' fight to attain these objectives has been marked by much the same maneuvering an[d] tactics on the part of those who would control thi[s] great natural resource for themselves. Althoug[h] this phase is continuing, much progress has bee[n] made. Early in June, power from Shasta an[d] Keswick power plants was carried to the Trac[y] switchyard over Government owned and operate[d] lines. Another public agency has contracted wit[h] the United States for CVP power, to be serve[d] in the near future under the recently signed wheel[-] ing agreement with the Pacific Gas & Electric Co[.] Negotiations will be pushed with other preferenc[e] agencies to effect as wide a distribution as possibl[e] of the benefits of public power. Folsom powe[r] plant, which will have 162,000 kilowatts capacit[y] and Nimbus, which will have 5,000 kilowatts, ar[e] under construction by Reclamation as part o[f] the American River development, a new ad[-] dition to CVP. Studies are underway on th[e] Trinity River, with its potential of 240,000 kilo[-] watts capacity. Central Valley basin's power po[-] tential of more than 8,000,000,000 kilowatt-hour[s] annually, has just begun to be tapped.

More encouraging, from the standpoint of ac[-] complishment, is the number of water contract[s] and the manner of their approval by the land[-] owners of the various irrigation districts whic[h] will receive project water along the various grea[t] canals and waterways of CVP. Already contract[s] have been executed with 15 irrigation district[s] which are being served, or will be served from th[e]

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"TO INSURE THE BLESSINGS OF LIBERTY" and freedom from the drudgery of backbreaking household chores is among them, made possible through the production of hydroeelctric power from the peoples' rivers, sent to the peoples' homes. ***Photograph provided through the courtesy of the Rural Electrification Administration.***

IT WASN'T EASY

ʏ the staff of the Lindsay Gazette

EDITOR'S NOTE: The orange and olive growing community of Lindsay, in the heart of the San Joaquin Valley, has been for many years a leader in the development of water resources of the Central Valley basin. An example of this community's interest in the Central Valley project was the vote on the Central Valley project special election in December 1933 when the people of that community approved the legislation by a ballot of 2,202–4. Ford A. Chatters, co-publisher of the Lindsay Gazette, has given permission for use by the RECLAMATION ERA of this article telling the story of the long fight to obtain water for the orange and olive groves of the Lindsay-Strathmore area.

THE ARRIVAL OF CENTRAL VALLEY PROJECT WATER the Lindsay district climaxed a 35-year struggle secure water from an outside source.

Numerous local citizens were active in the move bring outside water into this district, and into ıe South San Joaquin Valley, at a time when hers here in the county, who later became agressive "water plan proponents" actually were ghting these efforts. There were those who beeved the coming of Central Valley water would d and abet the Lindsay-Strathmore district in its tter legal struggle with the Tulare irrigation istrict, and some 40 ditch companies in the aweah River watershed. Now all are friends.

Earliest productive effort came at the legislative ssion of 1921 when Tulare County's assemblyıan, Charles W. Cleary of Lindsay, then serving s chairman of the assembly committee on irrigaon, drafted a bill calling for the appropriation f funds for the study of a comprehensive Stateide water plan, looking to the maximum use of all ıe waters of this semiarid State. He gave the bill to Assemblyman Bradford S. Crittenden, Stockton, retired State senator, for introduction. Together they saw it successfully pass both houses. It was signed, and intensive study by the State engineering department followed.

In the meantime the "Marshall Plan" was being advocated. It proposed a system of gravity canals skirting the foothills, bringing the excess flood waters of the Sacramento, American, and other streams, southward into the South San Joaquin Valley.

By the time the legislative session of 1929 rolled around, the studies had evolved into a concrete plan, essentially the same as now is being realized. A salt water barrier in the lower Sacramento, in the Carquinez straits, to furnish water to the industries suffering from salt-water invasion, was injected into the plan. Engineers saw this as impractical, and it stirred a legislative fight which blocked any legislation at that session. Later the fresh-water Contra Costa Canal was substituted.

Earl Houghton of Lindsay and Strathmore, who

UT IT WAS WORTH IT—As can be easily seen in the photo elow showing the contrast between irrigated orange groves nd dry farms not yet watered along the Friant-Kern Canal ear Lindsay. At right, George Trauger points with his ne at the Lindsay-Strathmore irrigation district's pumps hich lift water from the Friant-Kern Canal into the laterals.

just before, for 2 years, had been president of the California Farm Bureau Federation, headed an active legislative effort to secure the passage of the 1929 measure. Houghton and Ford A. Chatters, Lindsay, who handled a State-wide campaign through the press, remained in Sacramento throughout the 1929 session. For the first time the Central Valley plan was given legislative momentum and projected into the State picture.

Others at home helped, of course. John H. Turner, Lindsay, then was chairman of the Tulare County Water Commission. J. T. Crowe, Tulare, headed a committee supporting the legislative effort.

In the meantime, in 1928, a constitutional amendment was put on the ballot to modify the old English Common Law doctrine, then being applied to water law in California. The doctrine of "reasonable and beneficial use" was substituted. It had material relation to the over-all water picture, and in the exchanges of water necessary to realize the Central Valley plan.

The campaign for the act, before the November 1928 election when it was approved by a substantial margin, was headed up largely in this district. A Lindsay man wrote all the general publicity and, with Earle Clemens of Terra Bella, spent a month visiting every newspaper in the State. Lindsay-Strathmore irrigation district officials all were extremely active in this particular effort.

The late E. L. Daniells was president of the district at that time. Secretary H. R. Huebert and Engineer George W. Trauger, and some 5,000 or 6,000 residents of this district, took an active and intense interest. All can not be named here. Topside, Attorney General U. S. Webb showed a keen and friendly interest.

Then came 1933. Legislation again creating the Central Valley water project was introduced, in both the Senate and Assembly. Heading the list of co-authors in the lower house was Assemblyman Ford A. Chatters of Lindsay. Senator Frank W. Mixter, Exeter, headed a similar bill in the Senate. The Assembly bill, after a session-long struggle, emerged successfully and was signed by Governor Rolph. This measure called for a revenue bond issue of $170,000,000 for the construction of a water project substantially similar to that now being completed by the Bureau of Reclamation. It established also, the California Water Authority, which still exists under the terms of the act.

Held up by referendum, the act was approved b the people at a special election held in Decembe 1933. Lindsay cast the astonishing vote of 2,20 for the act, to only 4 against. Strathmore vote in similar proportion. A. C. Tienken headed fund-raising campaign. Altogether some $20,00 of Lindsay-Strathmore money was spent. Harol G. Schutt was chamber president at that time.

By this time, due to illness, W. B. Kiggens o Lindsay had replaced John Turner on the Tular County Water Commission. He, together wit Mr. and Mrs. George W. Trauger of Lindsay, wer actively advocating the passage of the bill at th 1933 session.

Secretary R. I. Clearman and the Lindsa Chamber of Commerce contributed a vast amou of effort and money. Through all the years o water struggle the Lindsay and Strathmor Chambers of Commerce were extremely active.

The Lindsay Gazette and Publishers, A. I Evans, and Ford A. Chatters, for three decade did everything a newspaper could do toward th realization of a dream which had to become reality if the district was to survive.

Charles F. Burr, then mayor, and city counci one after another likewise repeatedly took su official action as would aid in water developme efforts. Successive heads of the Lindsay Far Bureau and local service organizations, includin the churches, aided.

We are well aware that hundreds of citizens o the Lindsay-Strathmore area played outstandin parts in the fight for water and a realization o the Central Valley project. For that reason th is confined largely to those local persons who hel official status.

Many helped throughout the county. Commit teemen active over the 30 years could be men tioned, and some day will be recorded in the anna of the long struggle for an adequate and su water supply for the district.

To conclude. Soon after the Central Vall Act was passed in the California Legislature, an had been affirmed by the people, Federal, civi and public works agencies, and the Bureau of Re lamation began seeking projects that would qua ify for assistance and provide employment.

The California Water Authority turned th undertaking over to the Bureau of Reclamatio after extensive investigation by Engineer Walke R. Young, who later was placed in charge of th building of Hoover Dam.

THE EN

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ant-Kern and Madera Canals. A dozen more ;c filed requests for service from the Central lley project in the same area, and seven more tricts have indicated interest in receiving water m the Delta-Mendota Canal when that unit the CVP goes into operation in August.

As of this writing, the entire water supply avail-e from Millerton Lake, in an average year, has n committed to water users in the San Joaquin lley. Not only have CVP water contracts been roved by the people of the various irrigation tricts, but they have been approved by over-elming margins. For example, in the Lind-re irrigation district, the vote was in a 14–1 io for the contract. Lindsay-Strathmore voters proved CVP water contract by a vote of 188–1. Exeter, the ratio was 10–1. And in two dis-cts, Stone Corral and Saucelito, not a single gative vote was cast. The overwhelming ma-ity is significant. It is unmistakable evidence t these 9 (d) and 9 (e) contracts, written under clamation Law, and containing the acreage limi-ion features, are in accord with the will and needs of the vast majority of the valley's ter users.

In these districts, a $70,000,000 distribution tem program is under way, the cost of which is vanced to the water users by the United States, thout interest. This program is at present the largest single construction program remaining in the project. Shasta and Friant Dams, which create the great key storage reservoirs of the project, are completed and in full operation. Keswick Dam, which serves as a regulating structure for Shasta, likewise is in full operation. Shasta and Keswick power plants, with their combined capacities of 450,000 kilowatts, are producing power which soon will drive the project pumps, and service the farms, homes and industries of California. The Contra Costa and Madera Canals, two smaller but highly important offshoots of the project, are completed and delivering critically needed water. Central Valley project water is flowing through the Friant-Kern Canal, the lifeline of the San Joaquin Valley. With the exception of a few small works, this great new, man-made river is complete, to forever change the geography and history of the State.

Thus, in spite of great obstacles over many years, the initial features of the Central Valley project, man's most ambitious attempt to control and beneficially use the fresh waters of the earth, are ready for operation as an integrated unit. It is easy to say that completion of these features was a triumph in engineering. More significant, perhaps, is the acceptance of its broad social and economic aims, best told in terms of an old American concept of economic opportunity against concentration of power, and free access to economic opportunity. THE END.

One Hundred Years of Irrigation

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gislature for approval in 1933. The people of lifornia in December 1933 approved by a narrow rgin the right of the State to issue bonds for ancing the construction of the project. Because the depression the bonds could not be sold and l was solicited by the State from the Federal vernment. After a number of proposals and unterproposals were presented, the President of e United States authorized in December 1935 the nstruction of the Central Valley project as a deral Reclamation project to be operated in ac-rdance with Reclamation law. Plans and nstruction on the initial features progressed adily. In 1944 the two key structures, Friant d Shasta Dams, were completed and put in oper-on. With the completion of the Delta-Mendota Canal, Delta-Cross Channel, Tracy pumping plant, and the Friant-Kern Canal this summer, water from the Sacramento River will be exported to the San Joaquin Valley, and a plan which was conceived almost three-quarters of a century ago will be put into operation.

Although complete integration of all the irrigation facilities of the Central Valley project is being celebrated this August 1951, portions of the project have been in operation for varying periods of time. The Contra Costa Canal was the first unit put into operation when it began service to the Contra Costa area in August 1940. Early deliveries were primarily for municipal and industrial users. However, small areas of land conveniently located to the canal received the first project water for irrigation. The future will see a vast increase in lands irrigated by CVP. THE END

NOTES FOR CONTRACTORS

Contracts (over $100,000) Awarded During June 1951

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Co ar
DS-3291	Central Valley, Colo.-Big Thompson, and Missouri River Basin, Calif., Colo., and Wyo.	June 21	6 5,000-kilovolt-ampere mobile unit substations for emergency power supply.	Westinghouse Electric Corp., Denver, Colo.	$
DC-3330	Missouri River Basin, Wyo.	June 28	Construction of earthwork, structures, and surfacing for the relocation of 6 miles of State highway (U. S. 14), Keyhole Dam Reservoir.	Knisely-Moore Co., Douglas, Wyo.	
DC-3348	Eklutna, Alaska	June 6	Construction of 15.2 miles of Eklutna-Palmer 115-kilovolt transmission line, 1 mile of 12.47-kilovolt distribution line, and an electrical distribution system for Eklutna Government camp.	Wiggins Constructions Co., and Morrison-Knudsen Co., Inc., Anchorage, Alaska.	
DC-3356	Columbia Basin, Wash.	June 5	Construction of earthwork, asphaltic membrane lining, pipelines, and structures for 81 miles of area E-3 laterals and sublaterals, East Low canal laterals, schedule 1.	Minnis & Shilling and United Concrete Pipe Corp., Baldwin Park, Calif.	1,
DC-3357	Kendrick, Wyo.	June 25	Furnishing and installing two 18,950-kilovolt-ampere vertical-shaft generators for Alcova power plant.	Elliott Co., Jeanette, Pa.	
DS-3359	do	June 21	2 26,500-horsepower vertical-shaft hydraulic turbines for Alcova power plant.	Newport News Shipbuilding and Dry Dock Co., Newport News, Va.	
DS-3361	Central Valley, Calif.	June 25	48 vertical-shaft turbine-type pumping units for pumping plants S4, S5, S6, S7, S8, S9, S12, S13, and S14 on laterals 124.5E, 127.7E, and 130.4E, unit 3, Southern San Joaquin municipal utility district, Friant-Kern Canal distribution systems.	Berkeley Pump Co., Berkeley, Calif.	
DS-3370	Davis Dam, Ariz.-Nev.	June 6	4 new sets of windings for bank No. 3 power transformers at Phoenix substation.	General Electric Co., Denver, Colo.	
DC-3373	Missouri River Basin, N. Dak.	June 21	Construction of 43 miles of Bismarck-DeVaul 69-kilovolt transmission line.	Williston Construction Co., Williston, N. Dak.	
DC-3375	Gila, Ariz.	June 29	Construction of earthwork, canal lining, and structures for Mohawk Canal and Tyson protective dike and outlet channel.	Marshall, Haas & Royce, Belmont, Calif.	1,
DS-3386	Colorado-Big Thompson, Colo.	June 14	1 vertical-shaft pump turbine, 370 cubic feet per second at 240-foot head, and 1 13,000-horsepower vertical-shaft synchronous motor for Flatiron power and pumping plant.	Allis-Chalmers Manufacturing Co., Denver, Colo.	
DC-3387	Missouri River Basin, S. Dak.	June 11	Construction of 109 miles of Rapid City-Wall-Midland 115-kilovolt transmission line.	R. N. Campsey Construction Co., C. F. Lytle Co., and B & C Construction Co., Denver, Colo.	1,
DS-3389	Cachuma, Calif.	June 1	4 50- by 30-foot radial gates for Cachuma Dam spillway, item 1.	Berkeley Steel Construction Co., Berkeley, Calif.	
DS-3391	Missouri River Basin, S. Dak.	June 29	Galvanized-steel double-circuit towers and appurtenances for Oahe-Fort Randall-Sioux City 230-kilovolt transmission lines.	American Bridge Co., Denver, Colo.	4,
DS-3392	Missouri River Basin, N. and S. Dak.	do	Galvanized-steel single-circuit towers and appurtenances for Bismarck-Mobridge-Oahe 230-kilovolt transmission lines, Garrison Dam approach spans, and ties to switchyards between Oahe and Sioux City.	Bethlehem Steel Co., Bethlehem, Pa.	1,
DS-3400	Central Valley, Calif.	June 5	Construction of earthwork for powerhouse, warehouse, and penstock fabricating areas, tailrace channel, and tailrace channel access road, Folsom power plant.	Guy F. Atkinson Co., South San Francisco, Calif.	1,
DC-3408 and DC-3409	Missouri River Basin, N. and S. Dak.	June 29	Constructing foundations, erecting steel towers, and stringing conductors and overhead ground wires for 167 miles of Bismarck-Mobridge-Oahe 230-kilovolt single-circuit transmission line and 135 miles of Fort Randall-Oahe 230-kilovolt double-circuit transmission line.	Hallett Construction Co. and Continental Co., Crosby, Minn.	5,
DC-3417	Rio Grande, N. Mex.	June 26	Construction of 53 miles of Belen-Willard 115-kilovolt transmission line using overhead ground wires for entire length of line, schedule 1.	Malcolm W. Larsen, Denver, Colo.	
DS-3420	Missouri River Basin, Nebr.	June 25	3 radial-gate hoists, 1 lot of wire ropes, sheaves, sheave supports, and 1 lot of floats and accessories for Trenton Dam spillway.	Northwest Marine Iron Works, Portland, Oreg.	
DC-3431	Colorado-Big Thompson, Colo.	June 29	Construction of steel penstocks and manifold and concrete penstock structures for Pole Hill power plant and Flatiron power and pumping plant, schedules 2, 4, 6, and 8.	Southwest Welding & Manufacturing Co., Alhambra, Calif.	4,
DC-3434	Missouri River Basin, Mont.	do	Construction of Canyon Ferry-East Helena 115-kilovolt parallel transmission lines, each 8 miles long.	Askevold Construction Co., Inc. and Darnell Construction Co., Missoula, Mont.	
DS-3438	Columbia Basin, Wash.	do	10 horizontal-shaft centrifugal-type pumping units for Babcock pumping plant, W35.9 pump system, West Canal laterals, area W-8.	Economy Pumps, Inc., Hamilton, Ohio.	
DC-3439	Missouri River Basin, Wyo.	do	Construction of 10,000-kilovolt-ampere Lovell substation	McClellan & MacQueen, Inc. and Van Dyke Co., Worland, Wyo.	
DC-3441	Colorado-Big Thompson, Colo.	do	Construction of earthwork, canal lining, and structures for Horsetooth feeder canal.	Winston Bros. Co., Monrovia, Calif.	1,
DC-3442	Columbia Basin, Wash.	do	River channel slope protection at Grand Coulee Dam	Pacific Bridge Co., San Francisco, Calif.	2,
DC-3453	Shoshone, Wyo.	do	Construction of earthwork, asphaltic membrane lining, and structures for C-J Coulee crossing relocation, Willwood Canal, schedule 1.	Long Construction Co., Inc., Billings, Mont.	
DC-3454	Missouri River Basin, S. Dak.	June 28	Construction of Huron, Mount Vernon, Sioux Falls, and Watertown substations.	D. L. Varney, Inc., Omaha, Nebr.	
DC-3425	Missouri River Basin, Nebr.-Kans.	June 27	Construction of 16 miles of Courtland laterals, sublaterals, and drains.	Pecos Valley Construction Co., Carlsbad, N. Mex.	
100C-121	Hungry Horse, Mont.	June 1	Earthwork and structures, except bridges, West Side Forest Service Road, schedule 1.	Hoops Construction Co., Twin Falls, Idaho.	
100C-121	do	do	Earthwork and structures, except bridges, West Side Forest Service Road, schedule 2.	Miller and Strong, Inc., Eugene, Oreg.	1,
200C-159	Cachuma, Calif.	June 21	Clearing Cachuma Reservoir site	H. B. Adair Construction Co., Gardena, Calif.	
300C-24	Davis Dam, Ariz.-Nev.	June 20	Construction of service buildings and area improvement at system O&M area at Phoenix and Parker Dam Government camp, schedules 2, 4, 5, 6, 7, and 8.	Daum-Donaldson Construction Co., Phoenix, Ariz.	

Construction and Materials for Which Bids Will Be Requested by October 1951

Project	Description of work or material
Rapids, Mont.	Construction of drains and related structures for area 2, first division, near Glendive, Mont.
a, Calif.	1 42- by 28-inch venturi with meter, 36-inch tube valve, and 30-inch gate valve for Tecolote tunnel.
	1 24-inch butterfly valve with controls for Glen Anne Reservoir.
Valley, Calif.	8 vertical-shaft, propeller-type pumping units and three vertical-shaft, turbine-type pumping units for Sausalito irrigation district laterals.
	86 gate and swing check valves for distribution pipe lines, from 10 to 16 inches in diameter, for Southern San Joaquin municipal utility district.
	1 350-ton bridge-type traveling crane for Folsom power plant.
	3 oil-pressure, actuator-type, 261,000-foot-pound capacity governors for the 74,000-horsepower turbines for Folsom power plant.
	1 20,000-kilovolt-ampere and 2 5,000/6,250-kilovolt-ampere transformers for Folsom power plant.
	Construction of 102- by 322-foot steel warehouse at Folsom power plant.
—Big Thompolo.	Installing package-type substation, at Fort Collins, Colo.
	Construction of combination vehicle and power equipment maintenance shop, and a frame building for lumber and cement storage for service area at Loveland, Colo.
	Steel discharge pump manifolds for Willow Creek pumping plant.
	Installing 10 69-kilovolt switches and lightning arresters and moving 5 69-kilovolt circuit breakers, 1 8,000-kilovolt-ampere transformer, and lightning arresters for Green Mountain switchyard addition, near Kremmling, Colo.
ia Basin, Wash.	Producing and stockpiling approximately 25,000 cubic yards of crushed rock aggregates for road surfacing materials at Grand Coulee Dam.
	Construction of 17 miles of laterals and wasteways in lateral area P-2 on Potholes East Canal, 6 to 10 miles southeast of Othello, Wash.
	Drilling 7 domestic water supply wells for operation and maintenance areas in vicinity of Othello and Moses Lake, Wash.
	Modification of Pasco relift pumping plant near Pasco, Wash.
	Construction of Lower and Upper Saddle Gap pumping plants involving furnishing and erecting a 95- by 25-foot prefabricated steel building and installing pumping units; and construction of PE 17 pumping plant.
	Roosevelt memorial at Grand Coulee Dam.
	1 1,000-kilovolt-ampere transformer for Ringold pumping plant.
	Motor control switchgear for Ringold pumping plant.
	Transformers, switching and protective equipment for switchyards for Upper and Lower Scooteney, Lower Saddle Gap, PE 17, and Scooteney relift pumping plant substations and switchyards.
Davis Dam, Ariz.-Nev.	Construction of office building near Phoenix, Ariz.
Do	Construction of utilities and surfacing of streets and construction of spur railroad track for system operation and maintenance area near Phoenix, Ariz.
Eklutna, Alaska	2 vertical-shaft hydraulic turbines, each 21,000-horsepower for Eklutna power plant.
Do	Furnishing and installing 2 16,667-kilovolt-ampere generators for Eklutna power plant.
Fort Peck, Mont.	Conversion of existing Glendive pumping plant substation from 57- to 115-kilovolt operation, and construction of about 2 miles of 115-kilovolt tap line.
Do	Construction of 115-kilovolt Dawson substation near Glendive, Mont.
Kendrick, Wyo.	2 160-inch butterfly valves with control and handling equipment for Alcova Dam.
Do	2 20,000-kilovolt-ampere power transformers, 5 115-kilovolt disconnecting switches, and 2 115-kilovolt circuit breakers for Alcova switchyard.
Lewiston Orchards, Idaho.	Construction of 30- by 80-foot warehouse near Lewiston, Idaho.
Middle Rio Grande, N. Mex.	Construction of 17 miles of Rio Grande River drainage and conveyance channel and levee from San Marcial, N. Mex. to channel headworks.
Do	Construction of 23 miles of Rio Grande River drainage and conveyance channel and levee from Elephant Butte Reservoir to San Marcial, near Elephant Butte, N. Mex.
Minidoka, Idaho	3 11,100-kilovolt-ampere generators for American Falls power plant.
Missouri River Basin, Mont.	Generator voltage switchgear, surge protective equipment, and neutral grounding equipment for Canyon Ferry power plant.
Missouri River Basin, S. Dak.	Construction of 2,000-kilovolt-ampere Wicksville substation.
Do	Construction of 2,500-kilovolt-ampere Wall substation.
Do	Construction of 26,000-kilovolt-ampere Brookings substation.
Missouri River Basin, N. Dak.	Construction of 750-kilovolt-ampere Fort Clark substation.
Missouri River Basin, N. and S. Dak.	Fabricated galvanized structural steel for bolted steel towers for 115-kilovolt single-circuit transmission line approaches to Fort Randall Dam and Garrison Dam switchyards.
Missouri River Basin, Wyo.	Supervisory control and telemetering equipment for controlling Lovell and Thermopolis substations from Boysen power plant.
Okanogan, Wash.	Rehabilitation of Conconully dam outlet tunnel and spillway crest about 15 miles northwest of Okanogan, Wash.
Riverton, Wyo.	Furnishing and applying asphalt lining on 0.6 mile of Wyoming Canal, second division.
Do	Furnishing and applying asphalt lining on 15.5 miles of Wyoming Canal and 22 miles of Wyoming laterals, third division.
Do	Furnishing and applying asphalt lining on reaches of Wyoming Canal, first division.
Shoshone, Wyo.	Construction of waterways for drains in the Heart Mountain division.

United States Department of the Interior
Oscar L. Chapman, Secretary
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Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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Ruth F. Sadler, *Editor*

Subscription rate $1.50 a year for persons residing in the United States and Canada; $2 a year for foreign subscriptions; special rate of $1 a year for members of water users' associations, and Bureau of Reclamation employees.

OUR FRONT COVER

THE BIG LIFT

An aerial view of Columbia River lifting itself by its own power into the largest canal in the world. The canal empties 1.8 miles away into the Grand Coulee, ice-age channel of the Columbia River, which is now the storage reservoir for the Columbia Basin project. Grand Coulee Dam is in the background, 280 feet below the canal. This unusual photograph was taken by F. B. Pomeroy, Region 1 photographer, on June 14, 1951. For more information about the Coulee pumps, read The Big Lift on page 86 of the May 1951 issue, and see Russ DuCette's drawing on page 133 of the July issue.

30 YEARS AGO IN THE ERA

Change in Name of Grand River

Joint resolution to change the name of the Grand R in Colorado and Utah to the Colorado River. (Pub. No. 10, approved July 25, 1921 (42 Stat. 146).

Resolved by the Senate and House of Representat of the United States of America in Congress assemb That from and after the passage of this act the r heretofore known as the Grand River, from its sourc the Rocky Mountain National Park in Colorado to point where it joins the Green River in the State of U and forms the Colorado River, shall be known and de nated on the public records as the Colorado River.

SEC. 2. That the change in the name of said river s in nowise affect the rights of the State of Colorado, State of Utah, or of any county, municipality, corporat association, or person; and all records, surveys, m and public documents of the United States in which river is mentioned or referred to under the name of Grand River shall be held to refer to the said river un and by the name of the Colorado River.

(From page 428 of the September 1921 issue of RECLAMATION RECORD, predecessor to the RECLAMAT ERA.)

RECLAMATION PLACE NAMES IN THIS ISSUE

WATER AND THE WORLD

WILLIAM E. WARNE

sistant Secretary of the Interior

3Y THE END OF THIS CENTURY, or soon thereafter, world's population will reach 3 billion, accord- to Julian Huxley, former Director General of NESCO, unless some unforeseeable force op- ites drastically to reduce present rates of in- ase. There is enough food now produced in world to sustain this number if living were luced to the Asiatic level, and if all of the world's od were divided equally. But how many people uld be willing to accept these provisions?

Subsequent reports by the United Nations con- n Huxley's estimates and state the daily increase 70,000 people. In terms of numbers, if popula- n increases at the current rate, additional food ll be required for 25 million more people each ir. In terms of standards, the timetable for reasing food supplies must recognize the de- ability of providing decent meals for all who ll sit at the world's dinner table.

Of course, we cannot expand the earth's land a from which much of the needed increase in d must come. Of the world's 35.7 billion acres land, 29.5 billion have suitable temperatures, 22.7 favorable topography, 16.3 adequate soils, and 12.3 sufficient and reliable rainfall.

Consider the interrelationships of these factors. About one-third has suitable rainfall and temperatures. About one-fifth has suitable climate and topography. But only one-fourteenth (about 2.6 billion acres) has that fortunate combination of climate, topography, and soils needed to sustain what we colloquially call a "farm."

Each of these physical factors exercises a "veto" power over all others. The only one we can do much about is the limitation imposed by lack of moisture. Lifting this ceiling through irrigation is, of course, not the only means of increasing food supplies. Improvement of plant strains and other cultural practices will also contribute greatly.

In the whole world, only a little over 200 million acres, or six-tenths of 1 percent (0.006) of the land is irrigated, providing food for about 25 percent of the present world population, and in the western United States, irrigation projects, publicly and privately financed, provide water for farming about 25 million acres of arid and semiarid land.

People usually think of irrigation in connection with deserts, but there are a billion acres of non-desert cultivated lands (called humid and sub-humid) in the world which could be irrigated and provide an enormous increase in the amount of food produced.

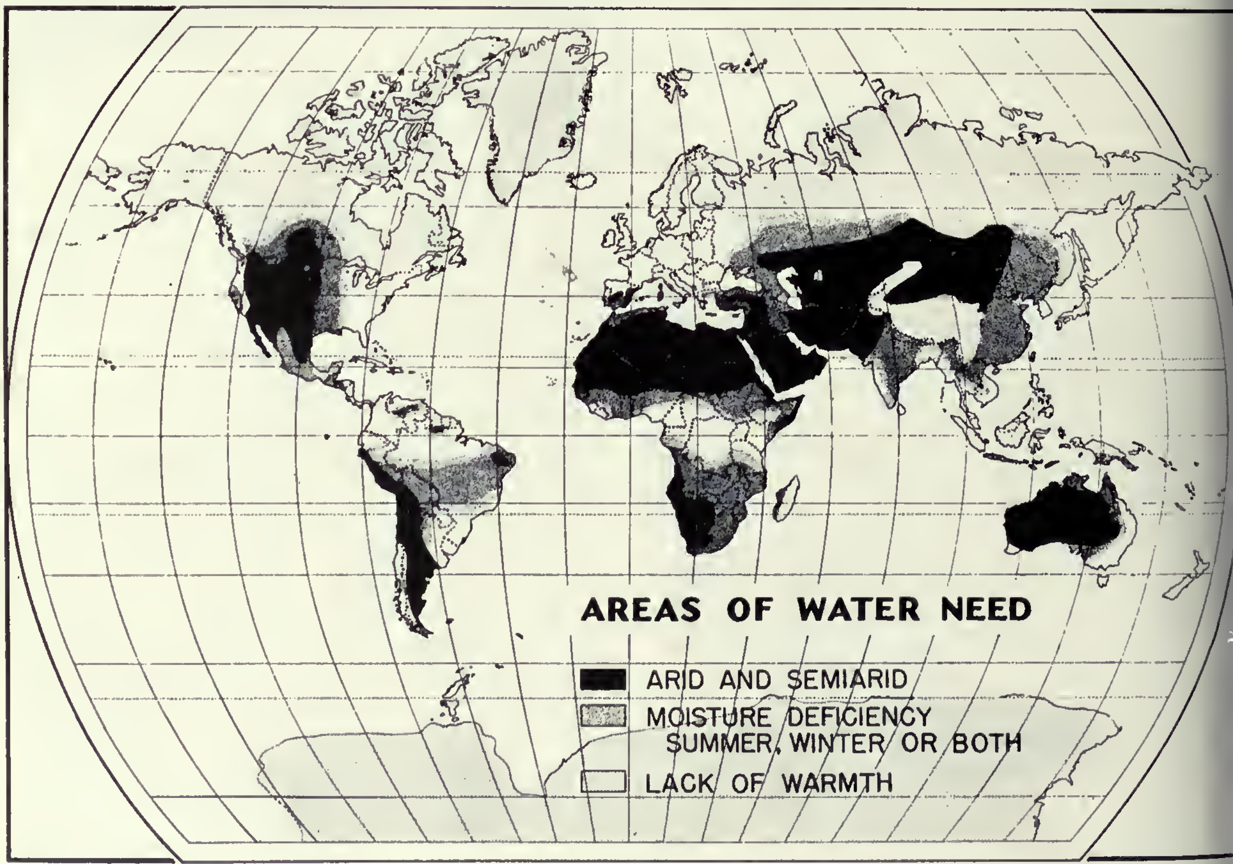
In fact, irrigation of crop land in humid areas already is beginning. Farmers in Iowa or in New York are making irrigation pay, and some of the most expensive irrigation works on record are installed in Panama, where the average annual precipitation is more than 90 inches. Other Central American countries with rainfall of 120 inches and more per year find that irrigation pays dividends.

Small amounts of irrigation water used during periods of seasonal deficiency would expand the selection of crops, and widen the horizons of agriculture, improving both the quantity and quality of crops. Irrigated lands in several parts of Asia produce two crops a year now, and in some of the warmer areas of our own southwest, certain lands are double-cropped. When associated with other cultural practices to protect the land, irrigation can make a contribution in some limited areas by taking advantage of an excee ing long growing season.

Among the principal areas where irrigati should supplement seasonal rainfall deficienci are those in central South America and in easte Asia and India. Other large areas in this catego are in central and southern Africa, Mexico a adjacent lands of Central America, Asia Min and the United States. These areas are indicat in grey on the map below.

About 200 million acres of deserts and nea deserts, where precipitation is too light to pern intensive cropping under natural conditio might also be developed to add another lar volume of food to the world's supply. A mu greater acreage can be reclaimed in the enormo area which extends in a broad belt across northe Africa through Asia Minor and on into the hea of China and Siberia. Other such areas are Australia, in the arid west of North Ameri and in South America, where inadequate p cipitation prevents or greatly restricts form agricultural operations.

Fifty years of investigations have placed t limit of irrigation feasible under present repa



nt policies in western United States at about million acres, including the presently irrigated million. Interregional diversions of water, the option of new concepts of national responsi-lity for irrigation, such as that suggested in the port of the President's Water Resources Policy mmission, and advances along the lines of the periments in rainmaking, or any combination these, might greatly raise this estimate.

The arid areas of the world which contain the 0 million acres which might be fully irrigated e indicated in black on the map.

To be sure, the irrigation of a billion acres now rmed and the development of 200 million desert res lie beyond today's economic and political rizons, but it could be expected to double the rld's food production. Let me emphasize, wever, that both of these totals are estimated in vance of anything like satisfactory world-wide idies.

It would take a great deal of water to irrigate ch vast areas, but I believe the water is available, incipally in rivers and lakes. The average dis-arge of the world's 80 major rivers is almost billion acre-feet annually. These 80 rivers clude only those which discharge annually at ast 10 million acre-feet into the oceans.

There are great diversities in precipitation and noff among the river basins of the world. Not one single major drainage basin is adequately provided with the rainfall necessary for optimum production throughout its entire area and throughout the whole of the growing season prevailing there.

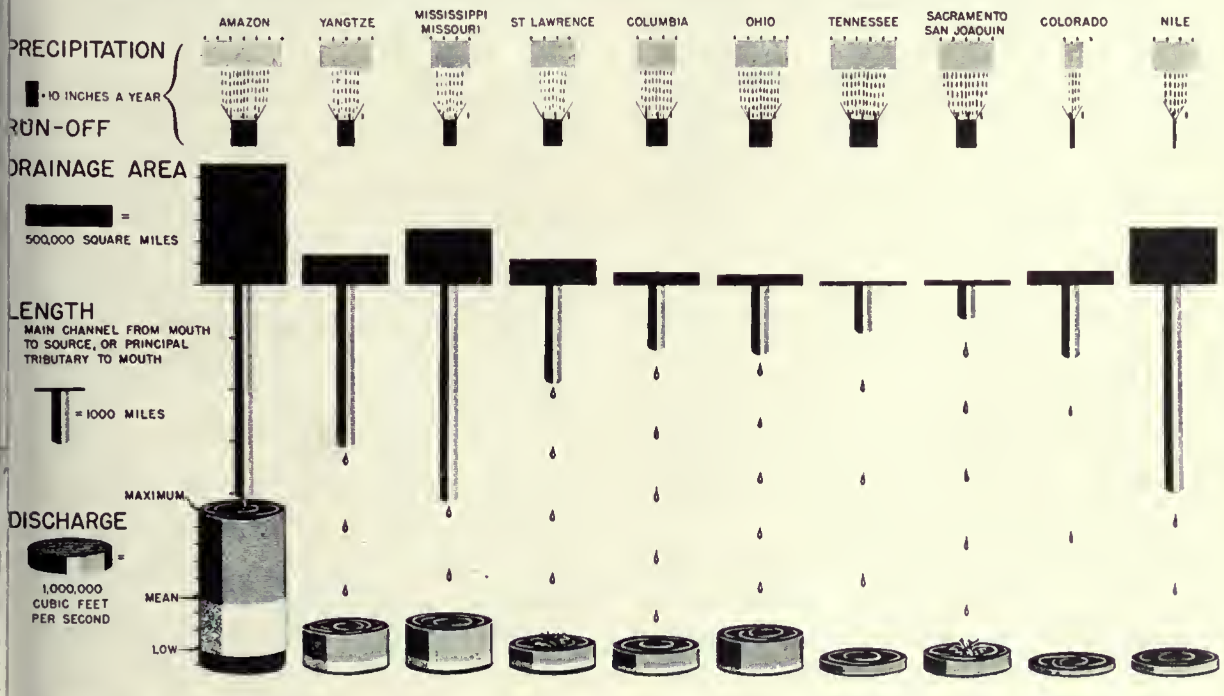
The flow of many rivers varies generally within narrow limits on a day-to-day basis and annually within tremendous extremes. As rule of thumb, the drier the area, the wider the fluctuation both daily and annually.

The chart on this page is a graphic comparison of the characteristics of several of the world's major river basins. It shows rainfall, flow, length of rivers, and size of drainage basins.

Water from wells has been a major source of irrigation supply since the beginning. As the concept of irrigability broadens and expands to include the delivery of supplemental water supply during relatively short periods of deficient natural rainfall, the importance of irrigation pumping from ground water will become more apparent.

The water supplies available in our rivers and lakes may some day be supplemented as technological advancement makes possible the reclamation of sea water for agricultural uses. The ancient art of rainmaking apparently is now being reborn as a science, and from this source some day may come the answer to many water problems. Only in fancy, however, could these possibilities

PHYSICAL AND HYDROLOGIC CHARACTERISTICS OF SELECTED RIVERS



be taken into account today as economic means of increasing the world's food supplies through irrigation.

The orderly development, now in progress in the United States, of river basins provides a pattern which many of the world's rivers could follow. The Food and Agriculture Organization (FAO), one of the specialized agencies of the United Nations, is giving increased attention to water resources for agriculture. The technical program of the United Nations itself is likewise exploring ways and means of helping under-developed countries to put their water resources to work. The Point Four Program of the President is laying heavy emphasis on the study of irrigation and related projects in under-developed areas. Engineers drawn from American industry and governmental agencies are now working under these programs in many parts of the world. Scores of technicians are being trained in the United States and in their own countries under su[illegible] vision of American experts in the skill necess[illegible] to adapt American methods to their own irr[illegible] tion problems.

There are many problems which will have t[illegible] worked out before technical assistance can be f[illegible] effective abroad. Among them is the remova[illegible] economic barriers which thwart developmen[illegible] many of the smaller nations of the world. P[illegible] Four offers a place of logical beginning.

The contribution to the relief of present f[illegible] shortages in the world and to the meeting future requirements of a larger world popula[illegible] through assistance in irrigation developmen[illegible] one of the most promising methods by which United States can contribute to world stability thus to world peace. THE [illegible]

(The above article is condensed from Assistant S[illegible] tary Warne's address at the Second Academic Confer[illegible] in Northwestern University's Centennial, Evanston, March 1, 1951.)

Missouri Basin Field Committee Marks Fifth Anniversary

Speaking at an informal meeting in Billings, Mont., on May 23, 1951, Assistant Secretary of the Interior William E. Warne announced, "Five years ago this month the Secretary of the Interior Department signed an order that brought into being the Interior Missouri Basin Field Committee. The purpose of the committee was to coordinate and to integrate the Interior Department programs in the Missouri Basin. During the 5 years of its life, your committee has been instrumental in achieving unity and coordination in the over-all program of the Interior Department for the Missouri River Basin. I congratulate you on your record of achievement."

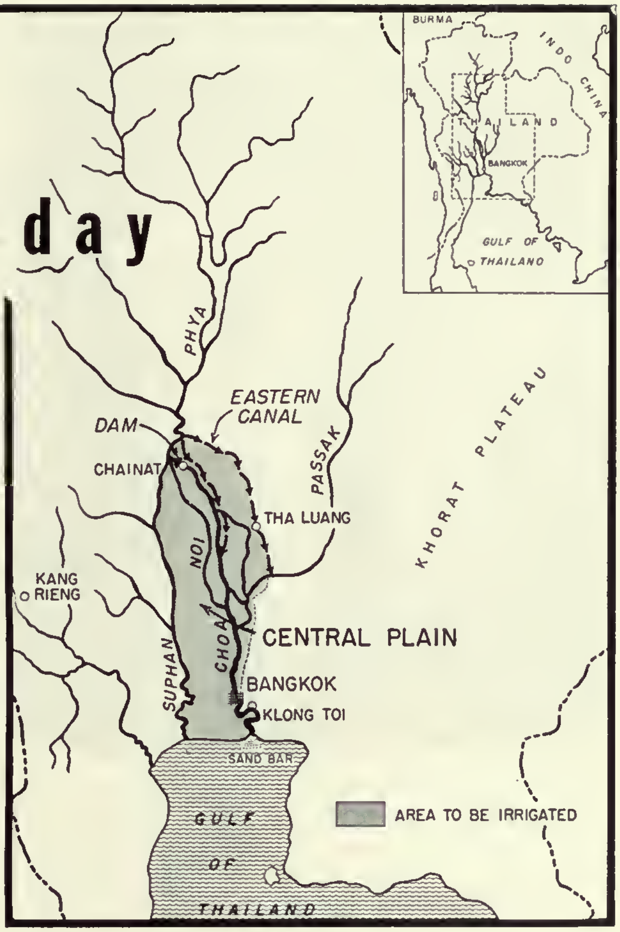
Secretary Warne then recalled the circumstances and events which led to the formation of the Missouri Basin Field Committee and commented that several of the original members were still serving with the committee, among them, H. F. Mosbaugh of Billings, former Supervisor of the Missouri Basin Studies Branch of the Fish and Wildlife Service, who was recently appointed chairman to succeed W. G. Sloan.

The Interior Missouri Basin Field Committee is a part of the coordinating machinery that has grown as a result of Congressional approval of the Missouri River Basin project, a plan for "Conservation, Control and Use of the Water [illegible] sources of the Missouri River Basin." Mem[illegible] ship of the field committee includes representa[illegible] from the Bureau of Reclamation, Geological [illegible] vey, Bureau of Indian Affairs, Bureau of L[illegible] Management, National Park Service, Fish [illegible] Wildlife Service, and the Bureau of Mines. [illegible] a voluntary coordinating group, operating at actual scene of operations. The committee h[illegible] about 10 meetings a year at various places in Missouri Basin.

The field committee roster includes Howard Baker, National Park Service; Avery A. Bat[illegible] Bureau of Reclamation, Region 7; Henry C. B[illegible] man, United States Geological Survey; Pau[illegible] Fickinger, Bureau of Indians Affairs; Albi[illegible] Molohon, Bureau of Land Management; Joh[illegible] Gottschalk (acting), Fish and Wildlife Serv[illegible] G. Warren Spaulding, Bureau of Indian Affa[illegible] Kenneth F. Vernon, Bureau of Reclamation, [illegible] gion 6; Paul Zinner, Bureau of Mines; and [illegible] rell F. Mosbaugh, Chairman, Department of Interior.

Today, there are seven Interior Departm[illegible] field committees, covering most of the impor[illegible] river basins in the United States and Alaska. [illegible] seven of the committes have been established a[illegible] the pattern set by the Missouri Basin Field C[illegible] mittee and perform similar jobs. •

ECLAMATION in Thailand Today



M. L. X. KAMBHU, Director General,
yal Irrigation Department of Thailand

As a representative of the Royal Thai Gov- xment, I want to say at the outset that we eatly appreciate the cooperation and the tech- cal assistance which we have received from the nited States Bureau of Reclamation.

This aid began in 1946. Up to now, 48 Thai rigation engineers have received most valuable -service training, in the Denver office of the ureau's Chief Engineer or in other regional of- es. In addition, two experienced design engi- ers from the Bureau are now assigned to the oyal Thai Irrigation Department on loan rough the Economic Cooperation Administra- n. The Bureau also is advising us on the de- gn of our largest dam, on which we expect to gin construction in 1952.

The kindness shown by the American Govern- ent comes at the right time, and for the right urpose. The production of more food is a more essing matter than ever, and the benefits from e Bureau's work will be immediately, and perma- ntly felt by our farmers, who compose 90 percent our population.

Although Thailand is situated in the monsoon d typhoon belts, she does not have sufficient infall for rice cultivation. The central plain, hich is the country's rice bowl, has a rate of infall only half as great as those of Burma and do-China, because the Malay Peninsula moun- in ranges along Thailand's western border check me inflow of orographic rains. Hydrological ta for the last 118 years show that there were 4 ood and 56 drought years, in which from a fifth a third of crops were destroyed. In at least of the remaining 62 years of more or less normal infall, some considerable portion of our crops as also damaged, either by the first heavy rains June, or by mid-season drought in July and ugust.

Through irrigation and drainage, however, a great deal can be done to stabilize and increase the crop yield. The Thai Government first started modern irrigation work in 1912, but progress was slow. Only 1.4 million acres had been brought under irrigation by 1948. In the meantime the population and the demand for food were increasing.

From 1906 to 1948, the population grew from 8 million to 18 million. Land under cultivation increased from 3.4 to 11 million acres; but much of the new acreage was opened up outside the area of natural inundation. As a result, the average yield of rice dropped from 750 to 450 kilograms per acre. At the same time, Thai exports of rice fell from 1.5 to 1.3 million tons a year. If this trend were to continue, rice annually available for export would amount to only over 1 million tons by 1960; and per capita earnings from the export of rice would be 62 percent less.

During World War II, the food problem was aggravated within Thailand itself. Transporta-

AN EXCHANGE OF SYMBOLS—The author holds a symbol of Thailand's construction program, an important "prime mover" in that country, as Commissioner Straus hands him a symbol of one of the Bureau's greatest structures now under construction—Hungry Horse. The elephant was donated to Commissioner Straus during his recent world tour by a project engineer of Thailand. As a gesture of friendship from the United States, the statue of Hungry Horse was donated to the Director General of the Royal Irrigation Department of Thailand during an official luncheon at the Department of the Interior. *Photo by Glen Peart, Interior Department photographer.*

tion lines were cut, shipments from the rice bowl to other parts of the country were greatly reduced, and in the southern part of the country, near-starvation was the result. It was at this time, roughly a decade ago, that the work of the irrigation department received an impetus which is still carrying us forward.

We began by laying out a program for the kinds of public works we would construct in each of the four major regions of Thailand. Next, we started planning and drawing up estimates for the specific projects which could be undertaken at the end of the war.

Finally, we have begun to create or acquire the elements of manpower, equipment, and financing that are necessary to carry out our program. I might first mention technicians. Since there are very few engineering contractors in Thailand, it is necessary for the department itself to do the construction and maintenance required. A tech-nical school has been established by the depa ment which is now producing about 40 technicia a year. These men can still benefit from more a vanced training, so that the opportunities afford for in-service training with the United Stat Bureau of Reclamation are most opportune.

In the second place, we need equipment. Th land has no surplus labor force, since its citize can earn their living direct from the soil. A fo of unskilled workmen is available for only months in the year, between harvest and plantir Therefore, to complete any development proj within a reasonable period, equipment is need to increase the productivity of available ma power. In this connection, it is fortunate th the Thai easily can be trained to be good n chanics, as the ECA has learned.

The ECA grant last year included equipme for carrying out water and soil conservation wo in the dry northeastern region of Thailand. W a loan of $18,000,000 made by the Internation Bank for Reconstruction and Development, shall be able to buy equipment to be used in t construction of a project on the Chao Phya Riv which will make possible proper water control f an area of 2¼ million acres of rice fields in t central plain. It remains for us to buy only t equipment needed in irrigation works in outlyi northern and southern regions.

The third necessary element is material. can obtain an adequate quantity of aggregat cement and lumber locally, so that only steel needed from abroad. At the present moment, though supply is rather short, we are able to b enough for our relatively small needs through t cooperation of the United States, Great Brita and the countries of Western Europe.

Finally, money is necessary. The Thai a ministration and parliament have supported t irrigation department vigorously since the end World War II. Our prewar annual budget w about 3 million bahts. In proportion to the r in the cost of living, our present budget would about 40 million bahts; but in 1951, our budg has become 200 million, or five times the expect average.

Thanks to such support, the irrigation depa ment has been able to increase substantially t amount of work done. For instance, during t 30 years before the war, water control was p vided for an average of some 47,000 acres a ye or a total of 1,400,000 acres. Since 1947, howev he average annual rate has risen to 140,000 acres, nd the total additional acreage in that relatively hort time has risen by 560,000. Now that we are ble to carry out larger projects, 2,850,000 more cres will be brought under water control by 1960. The total area under irrigation will be 4,810,000 cres, which is 43 percent of cultivated land.

In the present expansion of irrigation works, he former trainees of the United States Bureau of Reclamation have taken a very active part. Four re heads of divisions, six are heads of projects, nd the rest are in designing offices, in laboratories r in other key positions. All of them are competent and efficient, and they are making a major ontribution to our undertakings, which long have een needed for the prosperity of the farmers who re overwhelmingly the largest part of our opulation.

I always try to be cautious about making predictions, yet I feel confident in our ability to complete our projects in good form. We are grateful, I hardly need add, to the United States Bureau of Reclamation and to Commissioner Michael W. Straus for their good will and constant support. In Thailand, we appreciate the importance of making the most of our own resources, and the Bureau's help in enabling us to add to our skills in using those resources is assistance of the very first importance. Perhaps I should add just one more thing—that our story does not end in Thailand itself, for, as our projects materialize, we will be able to increase substantially our exports of rice to friendly Asiatic countries, and to lighten the constant pressure of hunger which bears so heavily on this politically important part of the world.

THE END.

Folsom Power Plant Under Way

Construction work on Folsom power plant, which will add 162,000 kilowatts of hydroelectric generating capacity to the Central Valley project was well under way in July. The Guy F. Atkinson Co. of South San Francisco, Calif., won the $1,463,721 contract for excavating 614,000 cubic yards of material for building a 7,000-foot long tailrace channel for the power plant. A total of 243,000 cubic yards of earth must be excavated for the power plant itself, and 43,000 cubic yards for a tailrace channel access road. In addition earthwork for a penstock fabricating area, and a warehouse must be performed according to contract.

Other contracts have already been let for manufacturing the 74,000 horsepower hydraulic turbines and electric generators to be installed in the power plant.

Folsom Dam is under construction by the United States Army Corps of Engineers, while construction of the power plant and related facilities will be under direction of the Bureau of Reclamation. When the dam is completed, its operation will be turned over to Reclamation as a part of the Central Valley project. •

Palisades Dam Approved as Defense Project

Palisades Dam and power plant on the main stem of the Snake River at Calamity Point, in eastern Idaho, has been approved as a vital defense project by the Defense Electric Power Administration. Construction will commence as soon as funds are available. •

Fly Ash Saves Money and Strengthens Canyon Ferry

A saving of about $625,000 in the cost of constructing the Bureau of Reclamation's Canyon Ferry Dam, the first major unit of the Missouri River Basin project to be placed under construction in Montana, will result from the introduction of fly ash, a waste material from industrial smokestacks, as a component part of concrete and a partial substitute for cement.

Studies by the Bureau's design offices in Denver and actual field operations have proven that ample strength and durability can be obtained at Canyon Ferry Dam by using a mix of 180 pounds of cement and 55 pounds of fly ash per cubic yard of concrete for the interior of the dam and 243 pounds of cement and 82 pounds of fly ash for the exterior of the dam in place of the 376 pounds of cement per cubic yard generally used for concrete in such dams as Hoover, Grand Coulee, and Shasta. Fly ash costs $11.90 a ton delivered at Canyon Ferry as compared to $21.29 a ton for cement—a saving of $9.39 for the substituted material. The fly ash also reduces the expansive reaction between the alkalies in the cement and the aggregate being used, thus assuring a more stable concrete in the dam.

(For further information on fly ash, read the article entitled, "Pozzolan" on page 191, September 1949 issue of the RECLAMATION ERA.)

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WITH THE STROKE OF A PEN a cycle of reclamation activities ends with the signing of a contract by the prospective irrigation water users who will begin another cycle of productivity and prosperity on the Bureau of Reclamation's Angostura unit in southwestern South Dakota. Seated, from left to right, at the contract signing are William B. Engelbrecht, board member of Buffalo Gap, S. Dak.; K. F. Vernon, the Bureau's director for Region 6; Bert Ray, chairman of the board, and C. A. Wilson, attorney for the board, a reside of Hot Springs, S. Dak. Standing are W. J. Burke, the Bureau counsel for Region 6; Joseph Gamet, board member; E. F. Lande holm, operation and maintenance supervisor for the Bureau Region 6, and Joseph W. Grimes, the Bureau's district manag for the Missouri-Oahe District, Huron, S. Dak.

ANGOSTURA AGAIN SHOWS THE WAY

by JACK BAILEY, Missouri Oahe District, Huron, S. Dak.

Region 6 (headquarters at Billings, Mont.)

A MILEPOST IN MISSOURI BASIN RECLAMATION was passed at Hot Springs, S. Dak., on May 29, 1951, when water users of the Angostura irrigation district and Bureau of Reclamation officials joined in a ceremony featuring the signing of a repayment contract, thus presaging a more stable way of economic life in southwestern South Dakota.

Through the signing of the repayment contract the way was cleared for building facilities which, within a couple of years, will bring irrigation water from Angostura Reservoir to 12,154 acres of land in the upper Cheyenne River Valley in South Dakota.

The Angostura document is one of the first reclamation repayment contracts executed in Region 6 since work got under way in earnest shortly after World War II on the comprehensive Missouri River Basin project.

K. F. Vernon, Region 6 director for the Bureau, signed the contract on behalf of the United State Government. Almost simultaneously with th contract signing, Chief Engineer L. N. McClella in Denver announced the award of the contrac for the irrigation structures of Angostura unit t Peter Kiewit Sons Co. of Omaha.

Representatives of the Kiewit Co. in attendanc at the Hot Springs meeting said that they planne to begin construction in time to be able to delive water to about 4,000 acres of the unit lands by th beginning of the irrigation season of 1952. Th remainder of the land in the Angostura unit i expected to be brought under irrigation by Ma 1953. About 92 miles of canals, laterals, and othe irrigation features comprise the facilities fo the unit.

Bert Ray, chairman of the Angostura irrigatio district board, and Floyd Haley, board secretar signed the contract on behalf of the water user Interested witnesses of the ceremony wer Joe Gamet and William Engelbrecht, two othe members of the district board, along with W. J Burke, regional counsel and Ed Landerholn regional operation and maintenance supervisor oth of the Bureau's Billings office; Joseph W. rimes of Huron, Missouri-Oahe district manger; Norval Enger, Hot Springs, acting construeon engineer of the Angostura unit, and C. O. Vilson of Hot Springs, eounsel for the irrigation istrict.

The tone of the meeting was set by board ehairnan Ray, a bronzed pioneer rancher of the area, n his opening remarks, "We have been waiting long time for this day to come. For more than 0 years we have been working for it. Damming ne Cheyenne and irrigating this land has been a herished dream of every generation since the 890's. It appears now that the dream is about o come true."

Representing a much earlier generation whieh ad worked for reclamation for the Cheyenne Valley—a land of sparse population, recurring roughts, crop failures and even grass failures at mes—is Mrs. Laura Gamet, now in her nineties. She was not in attendance at the meeting but a ood many of those present knew that she would e following the contract-signing proceedings vith great interest. Mrs. Gamet is the widowed randmother of Joe Gamet, a member of the irigation district board, and spent most of her adult ife as the wife of a rancher on lands on or near he unit. She still maintains a lively interest in the progress of the irrigation unit which she and other pioneers, most of them now dead, had expected to come into being many years previously.

Responding to Bert Ray's opening remarks, regional direetor Vernon said, "Today's action is a major milestone in the history of Angostura. Through this repayment contract Angostura becomes a true and complete representation of the multiple-purpose Missouri River Basin project unit. Because of the partnership entered into today between the landowners and their Government, water conserved and controlled in Angostura Reservoir can be put to beneficial use in the irrigation of about 12,000 acres, thus stabilizing the agricultural eeonomy of this whole area. This projeet will constitute an island of safety in periods of drought and is expeeted to increase farm income of the area by $600,000 annually.

"Eleetrical energy generated by the 1,200-kilowatt power plant under construction at Angostura Dam will provide 12 million kilowatt-hours of

(Please turn to page 196)

AN ISLAND OF SAFETY in periods of drought"—Regional Director ernon used this phrase to describe the Angosturo Unit, at right, here Peter Kiewit Sons Co. of Omaha is now building the facilities o bring woter from the reservoir, shown below, to the 12,154 cres of irrigoble lond. ***Photo by Chorles A. Knell, Region 6 hotogropher.***

CHEMICAL WARFARE against the burrowing rodent called the gopher is waged relentlessly by William Adam Batzner, below. At right is the old compressor, a length of hose, and a piece of used pipe which comprise the basic elements of his gopher-gassing device. All photos for this article by Phil Merritt, Region 1 photographer

GASSING the GOPHERS

GAS-WORK TAKES THE GUESS-WORK OUT OF KILLING GOPHERS ON CANAL BANKS

by HU BLONK
Regional Information Officer, Boise, Idaho

GENERALLY, WHEN SOMEONE THINKS of some better way to do a job, it's either the result of a desire to make the job easier, to make it safer, or to make more money.

But in the case of William Adam Batzner, it was intense hatred.

"I hate gophers!" said this 55-year-old campman at the Bureau of Reclamation field office in the little town of Notus, Idaho, the other day, gritting his teeth in disgust. He so despises them that in the fall of 1949, after trapping them for several years on the canal banks of the Payette division of the Boise project, he perfected a new, modernized method of killing the pests. His ingenuity has resulted in a sizable reduction in the cost of performing this annual maintenance operation.

The new land area, which is Batzner's battleground, embraces 53,000 acres of irrigable la[nd]. It is plagued, as are most irrigation projects, [by] thousands of gophers. They burrow thro[ugh] canal banks and would, if allowed to dig aw[ay] unmolested, cause costly and perhaps disastr[ous] canal breaks. An old gopher, they say, may d[ig] as much as a mile of tunnel in a year.

Up until about 1½ years ago, Batzner, who w[as] then "official gopher-catcher" on the division, [used] traps, 60 or more. An expert at the business, [he] killed as many as 1,330 during one 90-day peri[od]. But the process of covering the 500 miles [of] canals on the division was burdensome, ti[me] consuming, costly, and required handling th[e] pests, which is not exactly a pleasant experie[nce], even for Batzner, who had trapped some 5,000 [or] more.

Despite his outstanding record, Batzner wasn'[t] satisfied with his yearly kill. He so detested th[e] rodents that he lay awake nights thinking of ho[w]

› kill them faster. Today, because of that medi-ation, the job is being done faster, and cheaper, nd cleaner.

The new method employs calcium cyanide owder. These fine particles are blown, under ompressed air, into the network of gopher runs, here upon exposure to the moisture in the tun-els, they release hydrocyanic acid, which kills fe instantly.

Batzner took an idle compressor from the ware-ouse at Notus which had been used to pump up utomobile and carryall tires, and placed it on a eep. He fastened about 50 feet of quarter-inch ubber hose to the compressor and at the end f the hose attached an improvised metal chamber › hold the cyanide power and stir it up through ie application of air.

The chamber, which was made in about 2 hours, onsists of a 6-inch length of 3-inch pipe, welded hut at one end and provided with a screw-cap at he other. Inside this chamber is a quarter-inch alve, which controls the amount of compressed ir that may enter and thus regulates the amount f powder that leaves the chamber each time air s admitted. In front of the valve is a jet, which iixes the air with the powder, and behind the alve is a small hole through which the air and owder are blown out through the hose and into he gopher run.

Until Batzner perfected the compressed air de-ice, cyanide gas had been inserted into the run-ays by means of a hand-pump. This system as only partially successful. The gopher felt he change in pressure of the air each time the ump stem came down and hurriedly threw up an earth bulkhead to protect himself from what-ever he felt was coming after him.

The compressed air blows the killing fumes through the runs as fast as 150 feet in $1\frac{1}{2}$ minutes. At the time the photographs accompanying this article were taken, gas was inserted in one gopher hill and in 20 seconds it came out from another hill, opened up for the demonstration, some 60 feet away.

The monetary savings resulting from the im-proved killing method are easily discernible. Trapping normally required about 60 working days, at a cost of \$8.50 per day, or \$510 each season. About 60 traps were used, but two-thirds of them were lost during the annual operation. Cats and dogs would carry off gophers and traps, or human beings would steal them. This loss amounted to \$32. About 50 miles of driving per day was re-quired, at a cost of 10 cents per mile, or a total of \$300. The entire operation cost \$842 per year.

Compare this with the present system. A two-man crew can do the job in 10 days at a labor cost of \$160. The automobile expense, estimated at 70 miles per day, totals \$70. Fifty pounds of calcium cyanide costs \$25, making a total cost of \$245 per year.

Thus, the savings amount to more than \$500 a year. Use of the Batzner-perfected method on projects throughout the West would greatly multi-ply this figure, of course.

The labor-saving involved is quite evident. Setting two traps in a 150-foot run requires about 20 minutes. Now this area can be gassed in 5 minutes.

FFICIENT, ECONOMICAL AND EASY—At right, Batzner demonstrates the ıanner in which the hose is inserted in the gopher hole. During the ctual operation, the hole is closed to keep gasses from escaping. At enter, below, Bátzner shows what happens when a gopher isn't killed.

› will cost the farmer a lot to replace soil ost by water erosion resulting from canal reak. Below, the death-dealing metal hamber.

"To trap gophers you've got to be smarter than they are," Batzner said. "They'll see or smell your trap and cover it over with a mound of earth. Then you have to set it over. It all takes time. Then, too, one trap can catch only one gopher. One shot of gas may kill a dozen."

Batzner explained that the gassing is most effective in February or March, when the gopher has its first litter and the ground is damp, thereby sealing in the gas, which normally retains killing power for 2 or 3 days. Fall is the second best period to do the work.

The first step in the operation is to remove the gopher hill with a shovel, and then find and open the hole with a small blade. The hose, provided with a pipe end, is inserted and gas applied for about half a minute. The compressor has a capacity of 125 pounds, about 25 of which are used each gassing. The chamber is filled to about two-thirds capacity. Study of the operation clearly shows that once applied no further activity in the runs treated will be noted.

Batzner is proud of this equipment but he recommends several improvements. For one, he suggests a larger container for the cyanide powder to reduce the time-consuming loading operation, and secondly, he recommends a clear plastic chamber so that the amount of powder inside is always known. Also handling the cyanide powder is dangerous and separately packaged charges for the gun would make the operation safer on windy days.

But even as it is, the device constitutes a noteworthy contribution in the improvement of government techniques by a man who works with his hands but uses his head for thinking. THE END.

Angostura Again Shows the Way

(Continued from page 193)

electrical energy yearly for irrigation pumping and other uses.

"Angostura Reservoir is destined to become one of the most popular recreational areas in southwestern South Dakota. Through the cooperative efforts of the Bureau of Reclamation, the Fish and Wildlife Service, Forest Service, and South Dakota Game, Fish and Parks Commission, fish have been planted in the Angostura Reservoir and boating, swimming and other recreational facilities are being provided as rapidly as possible.

"I know that all of you share with me an appreciation of the true significance of what is tak ing place here this morning."

The Angostura unit lands are in Fall River an Custer Counties, the former on the south side o the river; the latter on the north. They will b served with water by a 30-mile-long main cana including a 2-mile-long siphon crossing of th Cheyenne River. The economic history of th area has been one of violent ups and downs cause by recurring severe droughts.

During the drought and depression of the thi ties many residents left the area and their lan was purchased under the emergency program i augurated by the Federal Government. Cons quently, about 75 percent of the irrigation distri land is owned by the United States. The So Conservation Service, Department of Agricultur is preparing this land for irrigation and ultimatel will sell it in family-sized tracts to qualified irr gation farmers.

A recent census showed that there are 26 farm ranch operators living in the unit area. In a election April 17, 1951, on the question of approva or disapproval of the proposed water user's co tract, the vote was 22 to 1 in favor of the contra with the Bureau. There were 29 landholde eligible to vote.

With the coming of irrigation, people of sout western South Dakota are envisaging an influx population to the district numbering perhaps 50 or more whereas today the rural population is e timated at a total of 120.

Angostura was authorized initially under th Water Conservation and Utilization Act of 193 as amended, better known as the Wheeler-Ca Act. The unit was approved in 1941 but the b ginning of World War II prevented initiation construction. Angostura was included in the Mi souri River Basin project authorized by the Floo Control Act of 1944 and was the first multipl purpose unit of the basin-wide plan to reach th construction stage. Work on the dam which located 8 miles southeast of Hot Springs, S. Dak began in the summer of 1946 and the structure wa completed in December 1949. Since that time, t water users have been working overtime to perfe their irrigation district program.

So it is that May 29, 1951, becomes another maj date in Angostura history. THE EN

(For additional information on the Angostura proje read the article entitled, "Angostura Shows the Way on page 234 of the December 1949 issue.)

GRANBY PUMPING PLANT, the "mainspring" of the Colorado-Big Thompson project, as it appeared 2 years ago this September. Less than a third of the actual structure is built above ground—the rest is subterranean. *Photo by M. F. Burg, Region 7.*

Colorado-Big Thompson's Mainspring

by C. S. SCRIBNER, Field Engineer,

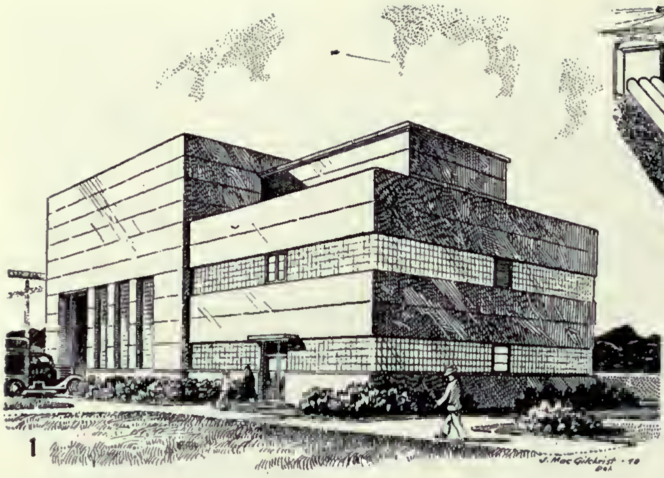
Grand Lake Area, Colorado-Big Thompson project, Region 7 (headquarters at Denver, Colo.)

Just as a mainspring is the motivating force which drives the works of a watch, so is the Granby pumping plant of the Colorado-Big Thompson project the mainspring which will set in motion project works stretching nearly 200 miles across the northern Colorado landscape. Here is forged the first link in a chain of beneficial results that will be bestowed on people and land on the eastern and western slopes of northern Colorado.

The water thus delivered will mean improved crops, which in turn will mean more benefits through profits to the farmer, to the merchant, to the city, to the county, to the State and to the whole country. And what's more, some of the energy produced by the pumped water returns to operate the pumps and thus lift more water. Perpetual motion you might say, but really it is better than perpetual motion, as the water which provides supplemental irrigation for 615,000 acres of land also provides electric power for use by irrigators, municipalities, and local industry.

The Granby pumping plant is located on the western slope of the Continental Divide on the north shore of Granby Reservoir some 100 miles northwest of Denver, Colo. This reservoir has been formed by the construction of the 298-foot high Granby Dam, which is the main storage facility for the Colorado-Big Thompson project, and has a total capacity of 544,867 acre-feet of water. The dam, located so as to intercept the maximum amount of flood water possible in the area, is lower than the Alva B. Adams tunnel which conveys the water to the eastern slope power plants and farm lands. That is why the water must be raised by pumping.

The Granby pumping plant is a reinforced concrete building constructed of some 18,000 cubic yards of concrete and 4,660,000 pounds of reinforcement steel. Its height of 188 feet is the equivalent of a 13-story office building. Only 50



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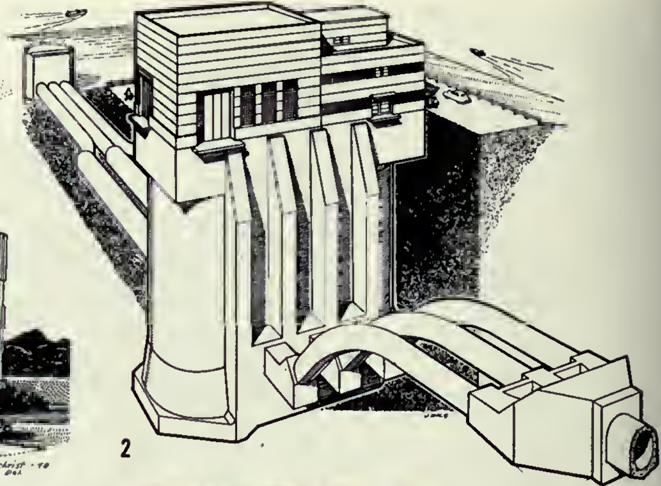

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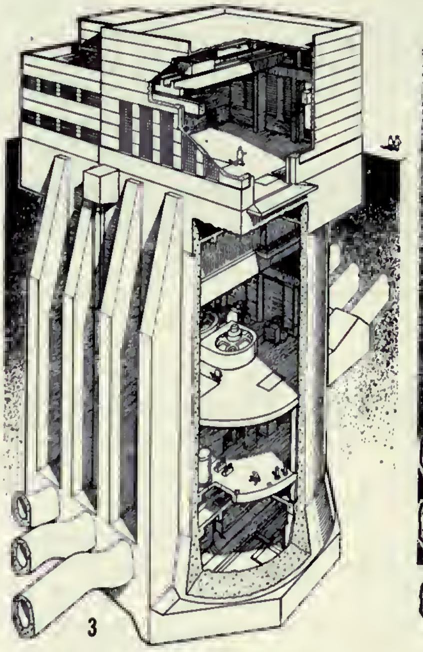
feet of this structure is exposed above the ground; the rest of the building is buried, since the reservoir water surface will fluctuate some 94 feet and the pumps must be located below the lowest level of the water. The three main pumps (each powered by a 6,000 horsepower electric motor) are capable of lifting to a height of 186 feet a minimum of 388 million gallons of water per day. As the reservoir fills, each pump will become more productive and when the reservoir is full, they will be able to lift about 632 million gallons of water each day.

Construction was started in April 1947 for the pumping plant and its related structures by contract with the Granby Constructors, an association of seven contractors combined especially for this job. Before any concrete could be placed, approximately 275,000 cubic yards of earth and siltstone had to be removed to expose a suitable foundation. The work of building the concrete structures, namely, the pumping plant, the intake structure, three intake conduits, each about 518 feet long, and a discharge conduit 3,350 feet long, was started in July of 1947 and substantially completed in November of 1949. After the building had been constructed, backfill was placed around it and up to the level of the main floor, 25 feet above the original ground, and 7 feet above the high water elevation of the reservoir. Since this work was located in a high mountain valley at elevation 8,287, winter came early each year and closed down the contractor's operations. Then, too, since the country had not recovered from the war, many materials were difficult to obtain, but the contractor pursued the work as rapidly as conditions would permit. In March of



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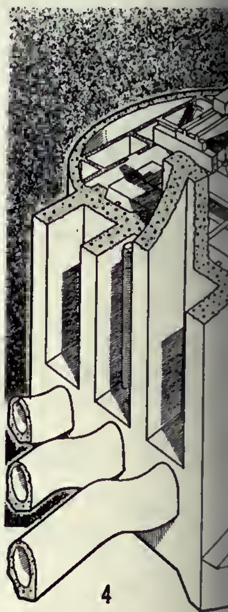

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1950 another contract was awarded to the Eichleay Corp. of Pittsburgh, Pa., for the installation of the main pumps and motors and related machinery. The remainder of the year of 1950 was spent in completing the building and in the early part of 1951 the Granby pumping plant was ready to operate whenever the occasion demanded.

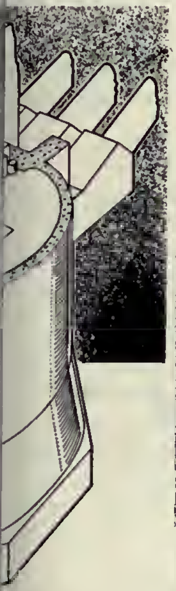
At the top of the hill north of the pumping plant, the discharge conduit terminates in a siphon-breaker house at the head of the Granby pump canal. The water discharged here flows by gravity through the 1.8 miles of the Granby pump canal, through Shadow Mountain Reservoir, through Grand Lake and into the 13.1 mile long Alva B. Adams tunnel under the Continental Divide (reputed to be the longest irrigation tunnel in the United States and to be the longest ever constructed exclusively from two portals). After passing through the tunnel, the water drops 3,000 feet, passing through four power plants before being stored in foothills reservoirs, until it is needed for irrigation by the farmers. By dropping this water through the power plants, electrical energy is produced for operating the project pumps and for general use.

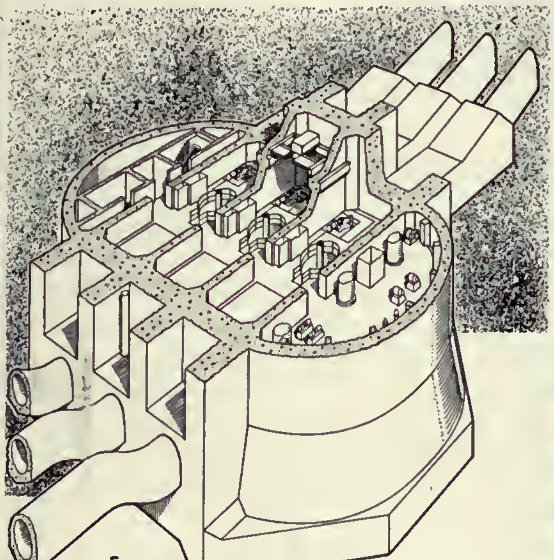
Coming back to the "mainspring," the pumping plant building is uniquely designed. The lower portion of the building, instead of being a conventional rectangular shape, like the portion exposed above the ground, has straight side walls and semicircular ends. The side walls are constructed of concrete 5 to 6 feet in thickness and braced by massive buttresses. The semicircular arched end walls are, however, only 3½ feet in thickness. This type of construction was found to be the most economical to withstand the tremendous pressures of the earth fill and reservoir surrounding the building and still provide a workable arrangement in the plant.

On the highest floor at elevation 8,315 is the hoisting apparatus for the elevator which serves the entire building.

On the floor below at elevation 8,301 but still above the ground, are the station service control room, the battery room, and a room containing part of the ventilation fans and heaters.

Next is the main floor, at ground level, where the main control room, the machine shop, a 50-ton





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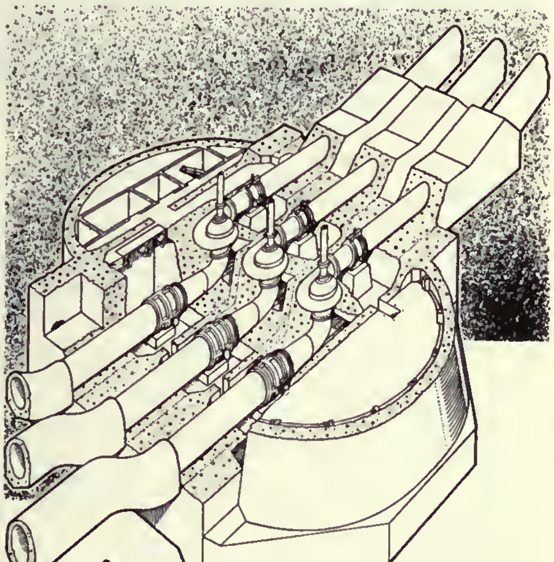

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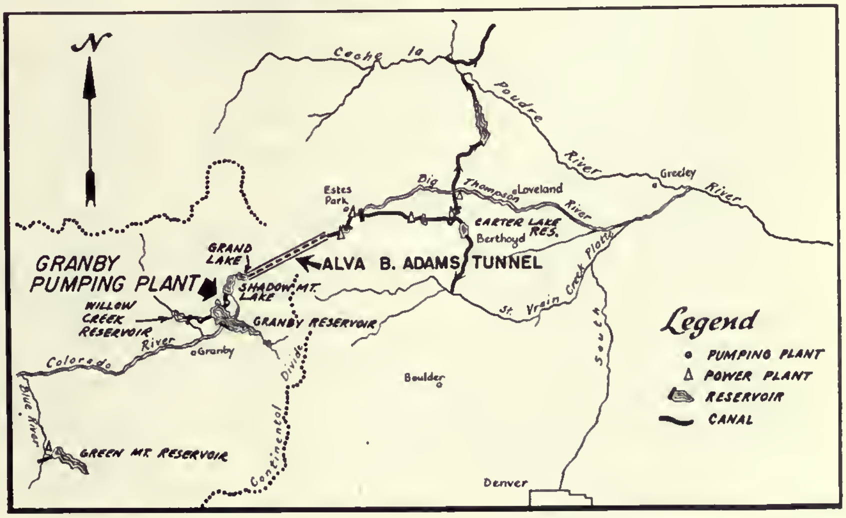
H MORE THAN MEETS THE EYE is revealed in cutaway drawings of the subterranean Granby ping plant. The "penthouse" in figure 1 con- the hoisting apparatus for the elevator, while the floor below is the station service control n. Figure 2 is another view of the 188-foot-high ture, showing how water is taken from Granby rvoir through the plant to the outlet pipes in the ground. Figure 3 gives a glimpse of the main , with its 50-ton traveling crane which can reach n into the lowest parts of the plant for machinery eed of repair or replacement. This drawing also s away the walls to show the floors beneath nd level—a tiny black section representing the e room, below that the store room, a slice of motor room, and a man at work in one of the p rooms. At the bottom are the floors for pump- out seepage water and keeping the pumps in d condition. Figure 4 represents the motor n, showing a hatchway being lifted by a 25-ton e at this level. Figure 5 is the floor with the e rooms, each with its pump shaft and butterfly e control system. Figure 6 shows the arrange- t of the pumps and the butterfly valves.



traveling crane, tool rooms, first aid room and the lavatories, are located. Hatchways (openings in the floor covered with removable steel covers) through all of the floors enable the traveling cranes to move machinery to any level in the building. The main control room contains all of the controls needed to operate the pumps, and also the radio and carrier current telephone which are used for transmitting instructions in the regulation of water and power for the project. Another feature of this room is the remote control board for regulating the spillway gates at the Shadow Mountain Dam over a mile distant, and intake gates at the Adams tunnel about 7 miles away. It is possible to regulate the flow of water into the Adams tunnel and in Granby Reservoir from the Shadow Mountain Reservoir by these controls. The floor immediately below the ground surface where the cable spreading room is located is at elevation 8,272. The power to run the pumps comes from the Green Mountain and the eastern slope power plants through 69,000 kilovolt transmission lines to the switchyard northeast of the building. The power transformers in the switchyard step-down the voltage to 6,900 volts for the pump motors, and power is carried to the building through cables in a connecting underground tunnel into the cable spreading room. This room might well be compared to a nerve center of the human body, as power is distributed from here to the entire building by means of cables in the vertical cable shaft which goes down through the building, and through conduits, other shafts and openings to the upper rooms. Also on this floor is another ventilation fan, the air compressors for service to the building, the water filtering and oil filtering room, the oil storage room and two (4,500 gallons per minute) turbine-type deep well pumps for unwatering the plant in case of flooding. Ample space has been provided in order that the power transformers may be brought in and set down on this floor and serviced.

The next floor at elevation 8,252 is for the storage of spare parts and supplies.

Immediately below this floor is the motor room at elevation 8,211. It is a most impressive room with the three completely housed 6,000 horsepower motors, their excitation equipment in adjoining cabinets and a 25-ton crane which serves this and the lower floors. The motor room, 76 feet underground, is large and spacious.

On the next floor, at elevation 8,186, are three nearly identical rooms each containing a pump with the top of the pumps and the shafts connecting the motors to the pumps visible. Adjacent to each pump is the discharge butterfly-valve control system which controls the valve between the pump and the discharge conduit. This control automatically closes the valve when pumping is interrupted by power failure. Each pump will turn 327 revolutions per minute while operating. By looking through the gratings set in this floor, it is possible to see both the discharge and intake butterfly-valve housings, which are eight and nine feet in outside diameter. One small crane serves this floor and may be moved from bay to bay by using the 25-ton crane located on the floor above.

Other floors below this level permit access to the valves and to the sump room where miscellaneous seepage water from the building is collected, pumped to the ground surface and discharged back into the reservoir.

Thus another completed step brings closer the great objective of the Colorado-Big Thompson project, which is to use beneficially the surplus water from the reaches of the Colorado River above elevation 8,280 for the purpose of supplementing the inadequate supply of irrigation water to farm lands lying below elevation 5,400, while at the same time developing greatly needed electricity for domestic and industrial use from the energy of that water dropping more than 3,000 feet between the supply and utilization areas on the eastern side of the Rockies. THE END.

Frenchman Cambridge Contract Confirmed

Final confirmation by the District Court of Red Willow County, Nebr., of a water service and repayment contract between the Federal Government and the Frenchman-Cambridge irrigation district has cleared the way for accelerated work on irrigation phases of the Missouri River Basin reclamation project in that State.

The authority of the Secretary of the Interior to negotiate a contract to furnish a water supply for irrigation purposes under the provisions of section 9 (e) of the Federal Reclamation Project Act of 1939, which had been challenged by a water-user, was upheld without change by the court as not in conflict with Nebraska State law. •

THE ITALIAN PEOPLE follow mission team investigating canal in San Giavanni in Fiori, southern Italy (at left). A mission investigatar and Italian officials of the Caulania project, below, at the project's mill where peasants bring their wheat and do their washing.

₹eclamation Under The Marshall Plan in Italy

/ W. E. CORFITZEN, Reclamation Specialist, Economic Cooperation Administration, Rome, Italy

ART 2—THE WORKING PLAN

EDITOR'S NOTE: In the July 1951 issue, Mr. Corfitzen outlined the beginnings of the plan devised for rapidly improving the Italian national economy, described the problems facing the Italian people following World War II, and explained how a general criterion was established that only projects would be considered which would guarantee a maximum production of food in a minimum amount of time with a minimum amount of money. In the following pages he goes further into the manner in which the plan was worked out.

AS A FIRST STEP in the investigation of the rogram, the mission requested that a report be repared on each project which would include parate sections on engineering, agriculture, and onomics. The reports were translated and disussed with Government officials, following which field inspection trip was made to each project. A field investigation was carried out by calling meeting of the project officials, including the chnical staff. This meeting was generally atnded by many more people than would be the ase in the United States. Besides local farmers, ne prefect, the mayor, other high officials of the national or local government, representatives of local cooperatives, unions, and similar organizations were present.

A representative of the mission briefly outlined the program of ECA assistance to Italy and what role reclamation played in the over-all program. The economic aspects of reclamation work were then stressed and emphasis laid upon the fact that we were more interested in the early production of food than in long-range projects or in features that would have no immediate bearing upon food production.

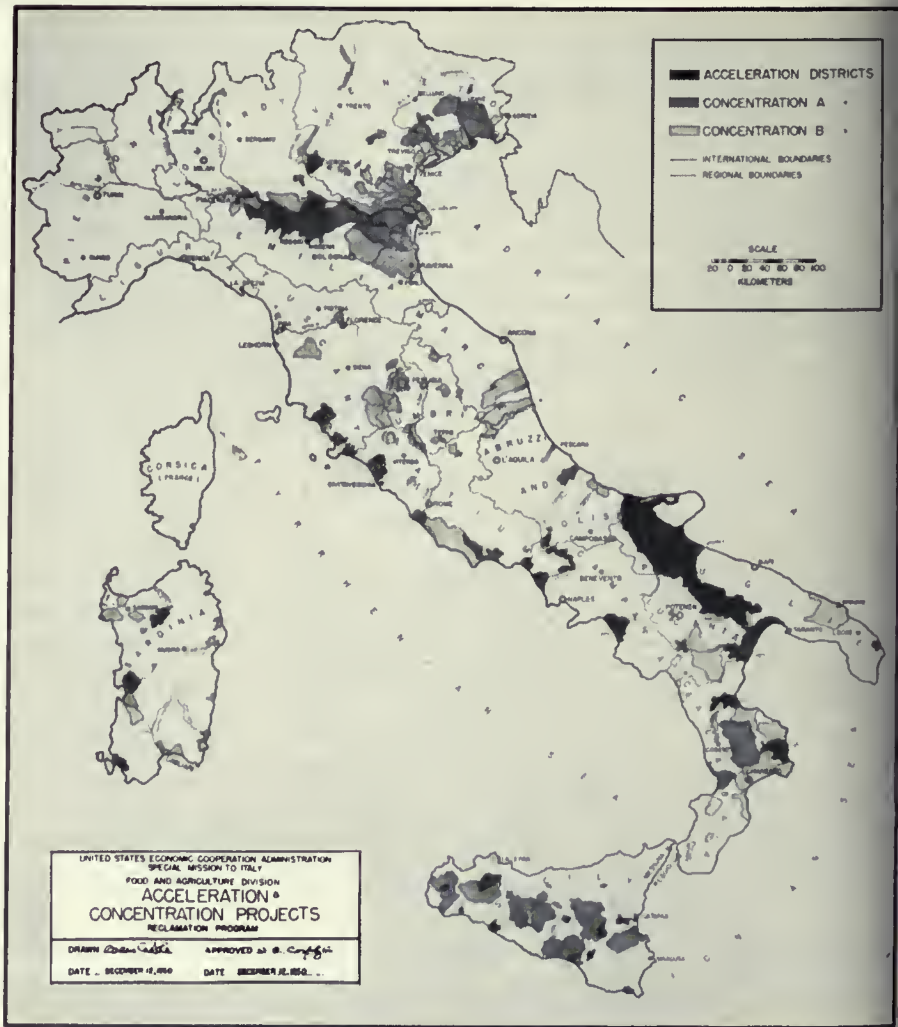
The project engineer was then requested to describe the project briefly, to show what had been accomplished since the project was originally constituted, and to explain in detail what work was planned for the period of ECA assistance, with particular emphasis upon features to be constructed with funds from the 1948–49 Counterpart Lira Fund.

After a complete discussion of the engineering and agricultural aspects, a trip was made over the project area by car and on foot to examine the site of every major feature as well as those of many minor structures and canals. Such detailed checking made it possible for mission investigators to observe the project staff which would have the responsibility for performing the proposed work and to evaluate what the staff had already accomplished over past years in a known amount of time and with a known amount of money. It also made possible the observation of actual field conditions relating to soil, cultivating, and harvesting methods, and enabled us to ascertain the probabilities of success in the agricultural program proposed.

This type of investigation was of infinite value in many ways. Government officials who in the past rarely had an opportunity, owing to the pressure of their administrative duties, to visit the field projects, accompanied members of the mission and took part in discussions involving thousands of questions relating to almost every conceivable agricultural and engineering aspect of the many projects. Of particular interest and value to the investigating team were the views of and discussions with, project officials and farmers scattered throughout Italy.

Italian groups became acutely aware of the weight which the mission gave to the economic aspects of projects and particularly to the cost-benefit ratio which the mission insisted must always be favorable before a project could be approved. Mission representatives, on the other hand, became aware of a great difference which exists in the thinking and the preparation of reports between American and Italian engineers and agriculturists.

Justification for many of the Italian projects was founded almost entirely upon social or political aspects while the economic aspects were often underrated. The social and political aspects, of course, could not be neglected, because this nation of 46,000,000 people (density=151 per square kilo



ITALY'S RECLAMATION PROGRAM as delineated on the map at right, submitted by the author, is divided into three categories. Projects along the coast and in the southern part of Italy are being given the acceleration treatment. This group includes 30 projects which are receiving ECA assistance for 4 years. Concentration A includes 48 projects which require ECA assistance to complete them and bring them to full productivity. There are 121 projects in Concentration B which will receive ECA money for 1 year, after which time the Italian Government plans to obtain funds from the regular budget to complete any work left unfinished.

eter) emerged from a world war with serious unemployment and attendant social problems. Mission investigators, therefore, obtained a real appreciation of the social aspects of unbelievably depressed areas and of the economic and social benefits inherent in employing large groups of men to do what a few machines ordinarily would do if the work were in the United States.

Upon completion of the field investigation, a detailed project report was prepared by the reclamation specialist, describing the project, drawing conclusions and making specific recommendations.

On the basis of these recommendations, funds were allocated from the Counterpart Lira Fund to the Ministry of Agriculture for release to specific projects. These projects were scattered throughout the Italian mainland and the islands of Sardinia and Sicily, as shown on the map, and involve three categories of projects: Acceleration, Concentration A, and Concentration B, which are a sort of priority assigned to the projects, but difficult to apply rigidly because of social aspects involving the need for employment on construction jobs.

These categories were defined as follows: Acceleration—projects constructed under a specific Italian reclamation law which provides for government assistance to reclamation features of certain specifically designated reclamation projects. The law provides that private landowners shall be notified that the government will construct certain reclamation works and that the owners of private lands must make provision to utilize fully the works provided by the government. If the landowners fail to develop their lands, the government has the power to expropriate the lands for public development. This group included 30 projects which would receive ECA assistance for 4 years (1948–52).

Concentration A.—This group involved 48 projects which also receive ECA assistance for a 4-year period. In general, the Concentration A group represents projects where both the government and private owners have achieved considerable success through works already accomplished in the reclamation field and where a concentration of funds is believed to be all that is now required to complete the projects at an early date and to bring them to full productivity. No provision is made in this group of projects for the expropriation of land as private owners have for the most part utilized the works already provided by the government and are fully cognizant of the benefits which may be derived through drainage and irrigation.

Concentration B.—This group consists of 121 projects and is similar to the Concentration A group with the exception that funds from ECA sources would be made available for 1 year only because the Italian Government believes that following 1 year of ECA assistance it would be possible to obtain funds from the regular budget for completion of those features not completed with ECA funds. It was believed that ECA assistance would make it possible to complete about 90 percent of the work required on this group of projects.

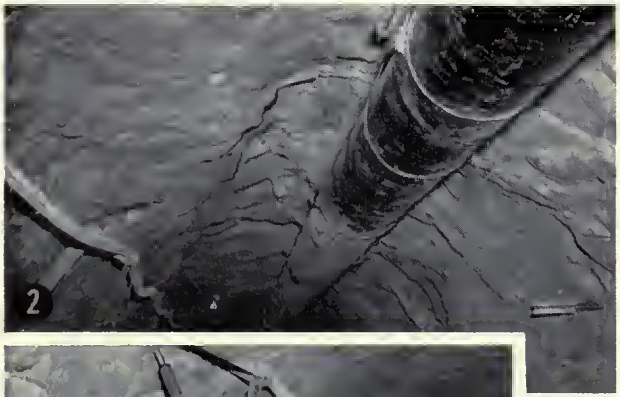
In addition to the above three principal phases of the reclamation program, there were three other categories: Antimalaria, war damages, and mountain basins.

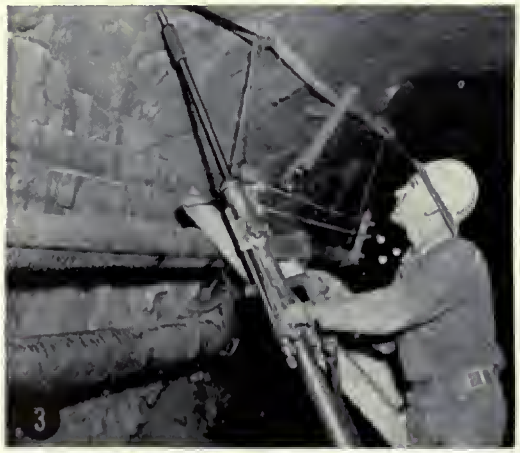
The antimalaria program was originally conducted as a part of the reclamation program in Italy and the Ministry of Agriculture was in charge of the works carried out. This was a very natural corollary of the reclamation program because the large areas to be drained were also infested with the Anopheles mosquito, which caused widespread malaria, and malaria control naturally became part of the reclamation program. These works generally included drainage canals, the elimination of stagnant water, and a procedure for spraying open bodies of water.

More recently, with the discovery of DDT, the campaign has been transferred to the High Commissioner for Hygiene and Public Health and the attack is now directed against the Anopheles mosquito through such action as the spraying of all bedrooms, kitchens, barns, etc., with a 5-percent DDT solution. In this way it has been found that mosquitoes have been eradicated before the eggs are laid with a consequent reduction in the number of larvae found in samples taken from stagnant pools and other mosquito breeding places.

(Next Month—Costs and Benefits of the Program)

NEXT MONTH
FORT SUMNER FORTIFIED
also
FARM AND PHEASANTS
How Reclamation Aids Wildlife Conservation and Development





ROOF BOLTS FOR DUCHESNE

PART OF DUCHESNE TUNNEL'S ROOF is "holding itself up by its boot straps."

At least that is the term once used by skeptics who doubted the effectiveness of the technique used for supporting a 200-foot section of this "problem child" among tunnel jobs.

Roof bolts are making one particular section of this tunnel in the Provo River project of Utah self supporting. They also have additional advantages—they are permanent; do not deteriorate or have to be replaced; they are not easily dislodged by blasting or moving equipment; they improve ventilation; give more overhead and side clearance, improve housekeeping, eliminate the need for storing bulky material, and are cheaper than conventional steel supports.

The principle of roof bolts might be illustrated by visualizing a loose stack of lumber suspended between two sawhorses, about 7 feet apart. What happens? The lumber sags in the middle, curves up at the ends, and if it is at all dry or has any imperfections, it splinters and sometimes cracks under the strain. But if you tie the lumber together, by driving bolts through it, you have a strong, straight, stack of lumber. Substitute the solid walls of the tunnel for the sawhorses, and the layers of rock making up the tunnel roof for the lumber, and you have the principle of the roof bolts, and an explanation of how these "sky hooks" hold the roof up safely. Actually, they reinforce the "skin" of the arch and hold the layers of rock strata so closely together that the planes can neither separate, spread apart nor flake off.

At Duchesne, the contractors (Grafe-Callahan Construction Co., and Rhoades Bros. & Shafner) used their own "home-made" variety of bolts—in two sizes, 5 and 6 feet, both 1 inch in diameter. They used "stopers" (pneumatic drills especially

THE WEDGE AND THE BOLT (1), a section of the Duchesne tunnel where roof bolts were installed (2), driving the roof bolt home (3, roof bolts in place (4), Bureau of Mines engineer Lester Nous of Salt Lake City, Utah, smiles as he proves you can't pull out one of these roof bolts, even with a 50-ton jack (5).

ıde for drilling upward—either straight up or agonally) to drill $1\frac{1}{2}$-inch holes, exactly deep ough to accommodate the bolt to be used. With acetylene torch they made a 6-inch slit in the tt-end of the bolt, inserted a steel wedge, and ed the stopers to drive the bolt and wedge into e hole. As the wedge reached the end of the le, the slit end of the bolt dovetailed, expand-g against the side of the hole and anchoring it firmly that even a 50-ton pull-out test cannot slodge it. They then pinned the rock strata gether by slipping a square steel washer and a lt nut to the exposed portion of the roof bolt, us preventing any spalling or slabbing. The les were drilled as nearly as possible at right gles to the natural planes of weakness in the cks.

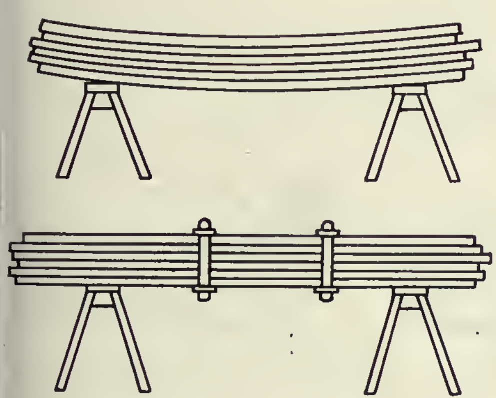
Those who read the article entitled, "Difficulties Duchesne" on page 88 of the May issue, will re-ll the "popping rock" and hard quartzite which ıs put Duchesne tunnel in a class by itself in the ugh construction category. After breaking the ual number of drill bits holing through a cer-in section, the contractor learned that for 200 et, the surrounding section was safe enough to ave unsupported. However, it was through artzite, which can "pop" and might slab off, if supports at all were used.

At this point, and rather than go to the expense enlarging the tunnel in that section to place nventional steel supports, the Duchesne engi-eers decided to use roof bolts. This practice is ot new, having been first tried systematically bout 20 years ago in a lead mine, and is now quite common practice in coal mines. The Bureau of ines has worked closely in connection with their e and has conducted tests on the bolts used in e Duchesne tunnel.

Duchesne is the second Bureau of Reclamation tunnel which has supported itself by roof bolts. When the contractor for the Keyhole Dam diversion tunnel of the Missouri River Basin project in Wyoming could not get steel supports when he needed them, he asked the Bureau if he could use roof bolts to avoid delays. The method proved very satisfactory in this particular case, as the sandstone rock was similar in character to that encountered in coal mines. Success at Keyhole encouraged the use of this type of construction in tunnels excavated through other types of rock.

In the Duchesne tunnel, where laminated hard rock is predominant, tests made in cooperation with the Bureau of Mines indicated that larger size holes were more suitable for bores through harder types of rock. While the roof bolt method of support, with certain limitations, is practical and economical in hard rock tunnelling, conventional steel supports will still be required in the majority of cases. This demonstration, however, has encouraged the use of roof bolts for all future Bureau of Reclamation tunnels, the latest being the Frenchman Hills tunnel of the Columbia Basin project in the State of Washington, the Eklutna tunnel in Alaska, and tunnels on the Horsetooth and North Poudre supply canals of the Colorado-Big Thompson project in Colorado.

For estimate purposes, the Bureau usually allows for 10 percent of the tunnel to be supported by roof bolts and 25 to 75 percent by conventional steel supports, depending, of course, upon the character of the rock. THE END.



LIKE THE LUMBER, when it is tied together with bolts, holds itself in a rigid position, tunnel roofs are also held up by roof bolts. Arched tunnels, like the Duchesne, can take advantage of the same principle. ***Drawing by the Bureau of Reclamation's Graphics Section, Washington, D. C.***

SHORT CUTS TO WEED KILLING CALCULATION

PART 4—HOW TO CALIBRATE YOUR SPRAY RIG

Suppose you are an irrigation district superintendent faced with a problem of keeping operation and maintenance costs down, using the latest weed-control techniques. You have carefully selected the chemical needed, you have decided on the best time to do the spraying, and you know the best results with a particular chemical are obtained when applied at a given rate in pounds per acre. Now how do you get the amount of chemical on the weeds—no more and no less? Just follow these steps.

1. Knowing your ditch bank and the spray equipment, decide on a convenient operating speed for the rig. For average conditions on the ditch bank, the speed of about 4 miles per hour is sati factory. Mark the throttle for the desired spee This is MPH (miles per hour) on the Nomogram

DETERMINE BEST OPERATING SPEED.

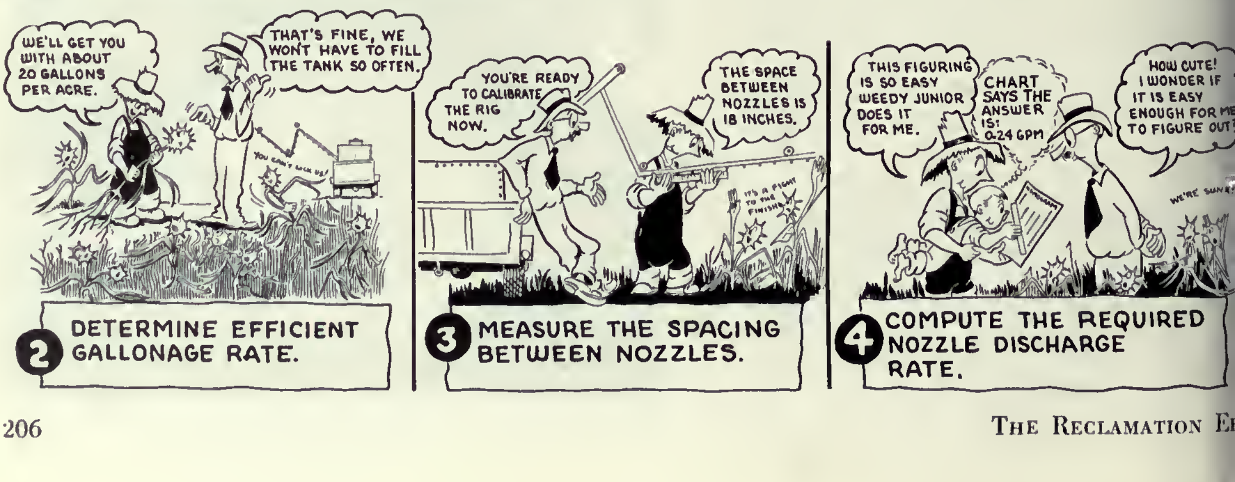
2. Consider the height of weeds, size of the spra tank, and type of spray solution, and decide up the best amount of spray solution that should put on per acre. This is the gallonage rate or ga lons per acre you want to apply. On the Nom gram this value appears on the GPA (gallons p acre) scale.

3. Measure the distance between nozzles on t rig. This is the nozzle spacing in inches or fe On the Nomogram inches appear on the NSI (no zle spacing in inches) scale and feet on the NS (nozzle spacing in feet) scale.

4. Using the Nomogram, determine the gallo per minute that each nozzle should put out to app the solution at your gallonage rate and spray speed. This value appears as GPM (gallons p minute) on the Nomogram. The GPH (gallo per hour) scale is on the graph for convenienc It gives the gallons per hour delivered by ea nozzle because sometimes it is more convenient use GPH instead of GPM.

5. Fill the tank with about 10 gallons of t spray solution to be used. You should use t same spray solution for the calibration as for t actual spray job because different types of sol tions come out of the nozzles at different rat under the same operating pressure.

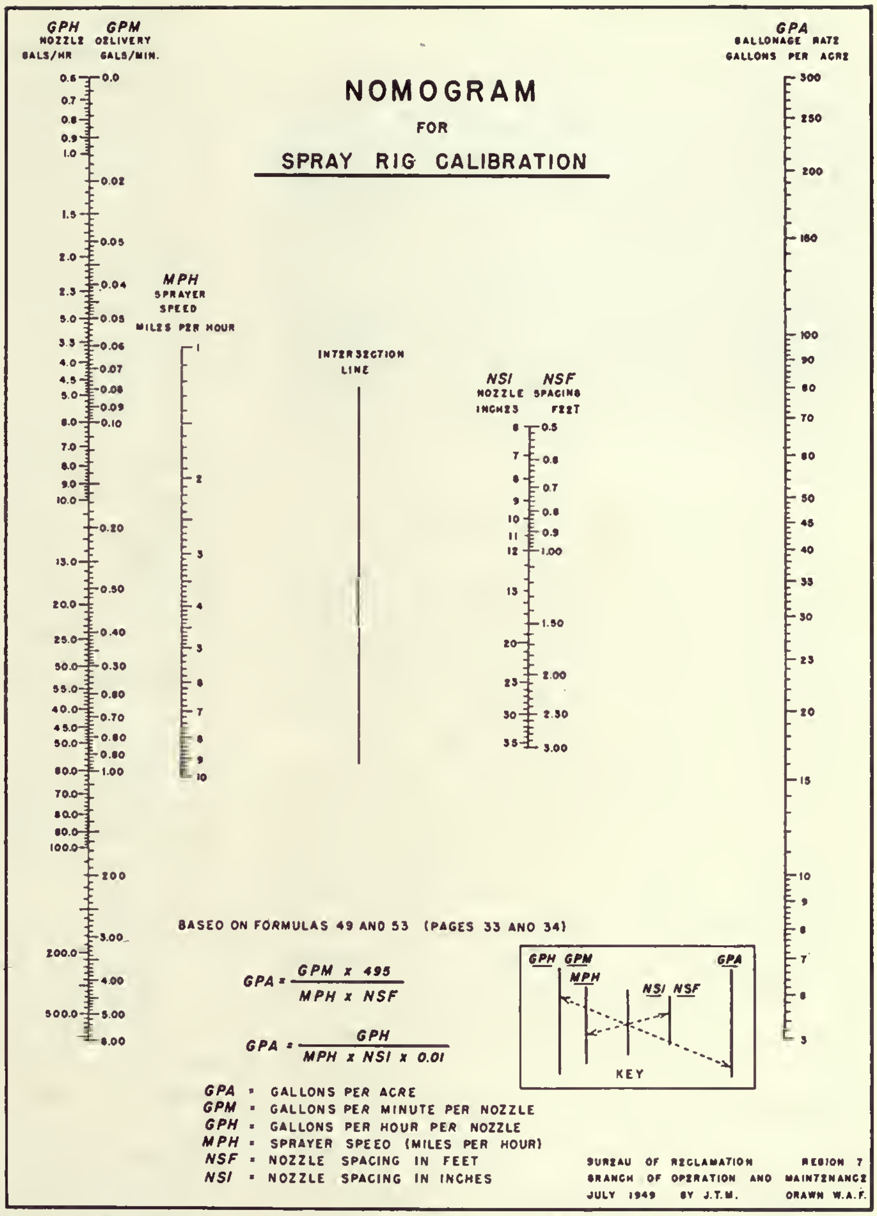
6. Adjust the operating pressure on the rig a value that will approximately give the desir



y JOHN T. MALETIC,

oil Scientist and Weed
pecialist,

egion 7 Headquarters,
enver, Colo.

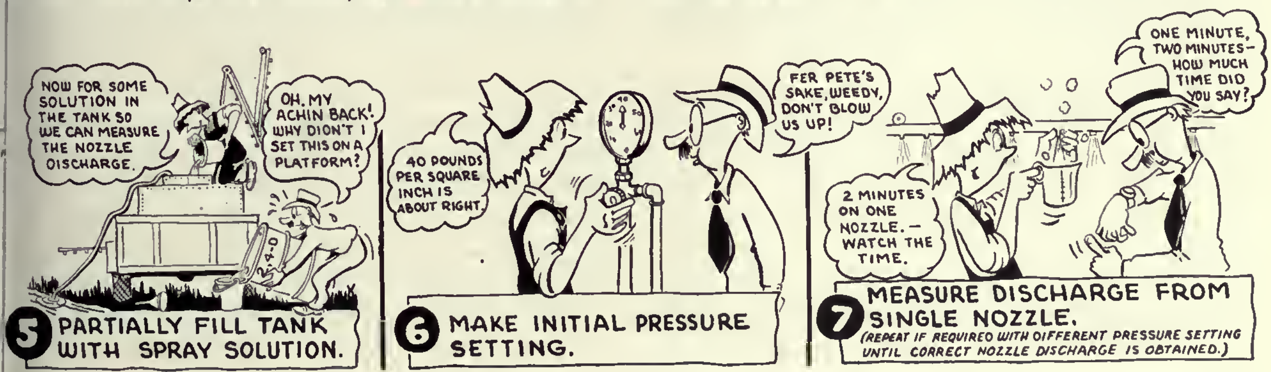


elivery in gallons per minute from ich nozzle. This can be done by ferring to the rating charts or graphs ut out by nozzle manufacturers. These arts show the delivery from nozzles aving various orifice sizes under dif- rent operating pressures. If these arts are not available, set the pres- ire at a convenient operating range.

7. Operate the rig and catch the ischarge from one nozzle during a -minute period. Use a convenient ontainer for catching the discharge that you can easily measure the mount caught and convert it to gal- ons per minute. If the measured dis- harge rate from the nozzle is the ame as that desired, the rig is cali- rated. If greater or less than the esired amount is discharged with the nitial pressure setting, increase or ecrease the pressure as required and epeat the nozzle discharge measure- ment until you get the desired rate. It s a good idea to check the discharge rom several different nozzles. All noz- les of the same make and size should ive approximately the same delivery.

The calibration procedure described bove is the best to use for most con- litions. Another method sometimes mployed may be briefly described as ollows: Obtain the nozzle discharge t a convenient operating pressure neasuring the delivery as described bove; choose a desirable sprayer peed; measure the distance between ozzles; then use the Nomogram to get he gallonage rate. If this gallonage ate is satisfactory for the sprayer problem involved, the rig is alibrated and ready to go.

Having calibrated the rig, you still have another step involving preparation of the spray solution before you can put on the right amount of chemical per acre. That is, the calibration assures that you will be putting on a definite amount of spray solution per acre; now then, you must also make sure that each gallon of spray solution contains just the right amount of chemical. The next article in this series will carry a simple Nomogram to help calculate the amount of chemical to put in the spray tank.



Vaud Larson Heads Region 3 Project Planning Staff

Vaud E. Larson, key Bureau of Reclamation engineer in Lower Colorado River Basin investigations the past 5 years, with 20 years of unbroken service with the Bureau, has been appointed head of the Bureau's Region 3 Branch of Project Planning, succeeding E. G. Nielsen, who moved up from the regional planning engineer's position last December to be Regional Director E. A. Moritz' assistant. Mr. Larson has been in charge of the Phoenix, Ariz., investigations office since December 1944, with the title of assistant regional planning engineer. •

Brown Dies in Nicaragua

We regret to announce the death of Boyd Scott Brown of Denver, Colo., Bureau of Reclamation civil engineer, who flew from Washington to Nicaragua with a Point Four Reclamation Bureau mission on May 26, and died in Managua of a heart attack on Friday, June 8, 1951.

Mr. Brown was born in Denver, Colo., July 22, 1912, and was a graduate of the University of Colorado with a B. S. in civil engineering. Before he joined the Bureau of Reclamation in 1939 he had served as surveyor with the United States General Land Office in Denver, had spent 2 years as a junior engineer in Chile, and had worked for the Mead & Mount Construction Co., of Denver and Dunlap & Brummett, Ltd., San Gabriel, Calif. He is survived by his wife and two children who reside at the family home, 3069 South Ogden Street, Englewood, Colo. •

Columbia River's Armor Takes Shape

The first chapter in armor plating the Columbia River below Grand Coulee Dam has been completed and the second chapter is about ready to begin. (See "Armor Plating the Columbia", p. 198, October 1950 Reclamation Era.)

The Morrison-Knudsen Co., Inc., Seattle, finished placing more than 1,000,000 tons of armor and riprap rock, mostly for the river banks downstream from the dam, in April. The contract, which was for $1,810,429.74, was started on December 7, 1949.

More than half of the tonnage in granite rock, which was taken from the granite-wall quarry nearby and downstream from the dam, was transported by cable ferry across the Columbia River. The total tonnage was 511,000 tons.

The rest of the job for protecting the riverbank involves placing approximately 160,000 tons of armor rock and approximately 25,000 tons of riprap, mostly under water in the channel area downstream from the dam.

The protection program is designed to protect the banks from the millions of horsepower in energy from the "unused" water which pours over Grand Coulee Dam spillway, in a 350-foot drop during the summer run-off season.

The bid award for the new chapter of placing the under-water rock was made on June 29, 1951. Almost all of the work must be done in the low water season. Only then does the Columbia flow quietly enough to permit the necessary barges and other equipment to work under the shadow of the dam. •

Reclamation Adviser to Remain in Ceylon

Paul von der Lippe, Bureau of Reclamation engineer on loan to the Government of Ceylon since October 1948, the first year the Ceylonese Government began to look to the United States for technical assistance with its development needs, will remain in Ceylon another year.

Under a new set-up, described as an "umbrella" type program for many kinds of projects, Mr. von der Lippe will continue his work of analyzing and recommending solutions for a wide variety of problems. These include technical, economic, administrative, and policy matters. Among them are the problems concerned with development of Ceylon's water resources and related economic and industrial developments in the over-all program of Dominion improvement.

A major program on which he is giving expert engineering advice is planning for rehabilitating or rebuilding extensive ancient irrigation works. Another is advising on the $15,000,000 Gal Oya Dam and power plant, a Ceylonese Government project which is being built in the heart of the Ceylonese jungle, under contract by a United States firm. To carry out this assignment, Mr. von der Lippe has penetrated the heart of the Ceylonese jungle where American engineers and Ceylonese laborers smashed down the jungle with bulldozers, and used modern tractors to build 3[illegible] miles of road to the site, about 85 miles from the city of Colombo. When completed, the Ga[l] ya project will impound water to irrigate approximately 100,000 acres, adding 5,000,000 bushels of rice yearly to the world crop, and furnish 0,000 kilowatts capable of providing energy for ig development in the sugarcane industry.

In addition to his advisory work on current rojects and problems, Mr. von der Lippe serves engineering consultant to the Ceylon Development Planning Board. This board formulates ng-range policies and plans for irrigation and ower production, road and bridge location, routng of transportation lines to load centers, land eform, industrial improvements, and related nancial and administrative matters.

Mr. von der Lippe, born in Oslo, Norway, is a aturalized American citizen. He holds a bachelr of science degree in civil engineering from the niversity of Technology, Trondheim, Norway. Ie has been with the Bureau of Reclamation, Deartment of the Interior, since 1935, specializing n canal, dam, and power plant structural design, xcept for a brief period in 1943, when he was urloughed for war work. •

Grand Coulee's Tenth Birthday

The tenth anniversary of the first power producion at the Grand Coulee Dam was observed on Iarch 22, 1951.

Where Grand Coulee kilowatts were a potential id to defense 10 years ago, they are today a reality. In the past decade, Grand Coulee has become he greatest producer of hydroelectric power in he world. The total of 59 billion kilowatt-hours f hydroelectric energy which has been produced s equivalent in production to the energy generated y burning 29 million tons of coal or approxinately 116 million barrels of oil.

Although it is the giant 108,000-kilowatt units vhich brought Grand Coulee its production fame, t was two of three small, 10,000-kilowatt-stationervice units which were the first to start on March 2, 1941. These three small units, now in service, rovide electricity for the dam installations and he Government town of Coulee Dam.

In addition, 17 of the 108,000-kilowatt units are n service. The sixteenth went on the line of the ower pool early in April. The seventeenth folowed in May and the eighteenth, and last, is to go n the line early this month.

When all 18 units of Grand Coulee are in operaion, their combined electric output will be equivalent on a 3-shift basis to the work of about 85 million men—or about one-third greater than all the male workers of the United States.

ALL ROADS LEAD TO GRAND COULEE—and the Bureau is building a four-lane highway between Grand Coulee and the top of Grand Coulee Dam. The 1.3-mile strip will use much of the existing road bed. Contractor for the paving job is Goodfellow Bros., Inc., Wenatchee, Wash.

The production of Grand Coulee in 1 year, without the final 3 units, represents enough energy to build 50 battleships.

Three 108,000-kilowatt units are enough to light all the dwellings in New York City and Chicago combined.

The current installed capacity of the plant is 1,866,000 kilowatts, although at peak operation (at which the units have been safely run for much of their history) the rating is 1,974,000 kilowatts. Bureau of Reclamation engineers estimate that one generator working for 1 day earns $5,000. •

First Reclamation Apprentice Graduates

Harvey W. Boyce, Boulder Canyon project electrician, became the first Reclamation apprentice to graduate in the Nation when he received his "diploma" on April 16 in a ceremony at Hoover Dam. At the same time, the project's Director of Power L. R. Douglass handed Boyce his promotion from apprentice to journeyman electrician.

Mr. Douglass said that the Boulder Canyon project scored two "firsts" with Boyce's graduation. He is also the first to start the training program of apprentices for journeyman status in the six basic crafts—carpenter, automotive mechanic, machinist, painter, plumber-pipe fitter, and electrician. A certificate for the apprenticeship course was issued to the project by the United States Department of Labor on August 1, 1949. •

WATER REPORT

The highest floods of record which occurred on the Kansas River and on the Missouri River from Kansas City to its junction with the Mississippi during July did not affect any existing Bureau of Reclamation projects. A flash flood on Cottonwood Creek, a tributary of the Niobrara River in northwestern Nebraska, during the latter part of the month, washed out the main canal of the Mirage Flats project, but it was anticipated that repairs, estimated to cost $15,000, would be effected and water deliveries resumed in time to avert any crop damages.

Irrigation water supplies as of August 1, 1951 continued to be plentiful over most of the West, but the extreme drought continued without relief in Arizona, New Mexico, and Texas. Only 90,000 acre-feet of water remained in the six reservoirs of the Salt River project, and less than 135,000 acre-feet was in storage in Elephant Butte and Caballo reservoirs of the Rio Grande project, setting another new record low. Water supplies are also short in the Pecos River Basin and in the San Joaquin Basin, in south-central California.

By regions (see map on back cover for locations) the situation is as follows:

REGION 1—the outlook remains generally excellent. Hot, dry weather occurred over a major part of the northwest, but storage was ample in all cases to take care of the resulting heavy demand for irrigation water. Two pump units at Grand Coulee Dam were operated during most of the month, pumping a total of 143,000 acre-feet of water into the Grand Coulee Equalizing Reservoir.

REGION 2—inflow into Shasta Lake during July was about 95 percent normal, while the inflow into Millerton Lake was 79 percent of normal. All projects will have sufficient irrigation water except for the Friant-Kern and Madera Canal service areas below Millerton Lake where the supply will be insufficient to meet all demands.

REGION 3—storage in Lake Mead remained below normal, with flow into the reservoir during the month including the last of the snow runoff from the upper basin. Irrigation water supplies will be sufficient on all projects in the region, however, except on the Salt River project in Arizona where conditions remain critical.

REGION 4—conditions are generally good. Rains in the headwaters of the Uncompahgre and Gunnison rivers improved the water situation for the Uncompahgre project materially. It is anticipated now that all projects will have sufficient water for maturing normal crops.

REGION 5—water supplies are plentiful on the W. C. Austin and Tucumcari projects in the northern part of the region, but there has been no relief from drought in southern New Mexico and Texas. Upon demand of the Carlsbad Irrigation District, all water stored in Alamogordo Reservoir was released for project use. Storage in Elephant Butte and Caballo reservoirs of the Rio Grande project reached another new record low, and it is anticipated that the entire storage will be virtually depleted by the end of the irrigation season.

REGIONS 6 AND 7—irrigation prospects are from good to excellent on all projects except the Belle Fourche in South Dakota where it is expected that the water supply will be barely sufficient for production of normal crops, with no carry-over storage in prospect in the Belle Fourche Reservoir. ●

LETTERS

Paging Lloyd Lewis

Our Denver office received the following letter, without a return address, or decipherable postmark. We have checked our subscription lists and cannot find the writer's name therein. Will he, or someone who knows him, please send his address to the RECLAMATION ERA? We don't like to leave letters unanswered, but we have to know where to send them.

DEAR SIR: I noticed in the RECLAMATION ERA of June 1951 that a contract has been recently executed between the Government and the Kansas-Bostwick irrigation district which provides for the irrigation of 49,000 acres in northern Kansas.

As I am particularly interested in th possibilities of irrigation in our Stat I am wondering if it would be possibl to obtain a copy of the above mentione contract.

If extra copies are available I woul appreciate your mailing one to me.

Very truly yours,

LLOYD LEWIS.

Purity Pays

EDITOR'S NOTE: District Manag M. J. Miller, of the Lower Colorad River District, is still receiving a floo of letters as a result of the public tion of "Yuma Homesteaders 'De-Bu Water" in the December 1950 issue o the ERA. Correspondence has als poured in to the Washington, D. C office from people who are intereste in this article on making ditch wat safe to drink. The inquiries have co from people in Montana, North Dakot South Dakota, New Mexico, Washin ton, California, Oklahoma, Idaho, V ginia, New Zealand, and Canada. He are a few samples.

ARIZONA STATE DEPARTMENT OF HEALT
Phoenix, Ari:.

DEAR SIR: Our attention has bee drawn to an article appearing in t RECLAMATION ERA for December 19 in which a water purification unit d veloped by your office is described.

This office has received inquiries fro health departments in other States a to the details and our approval of t unit. It would therefore be greatly a preciated if you would furnish th office with descriptive literature, d tailed drawings, operating instructio and/or other information issued to i dividuals interested in purchasing building such a unit.

We would also appreciate receivi a summation of the methods and resu of testing the performance and reli bility of the unit.

Very truly yours,

GEORGE W. MARX,
C.E., MP.H., Director and Chief Engineer, Bureau of Sanitation

WASHINGTON WATER POWER CO.,
Coeur d'Alene, Idaho.

DEAR SIR: The Kootenai Coun health department has brought to o attention the article written in the D cember issue of the RECLAMATION E regarding the sterilization of wat with germicidal lamps. This is new me and I would appreciate any inform tion you could send on such install tions.

We have a definite need for such a application in our territory.

Very truly yours,

W. A. LOWRY,
Washington Water Power Co., Coeur d'Alene, Idaho.

ISTERY OF WORKS,
Wellington, New Zealand.

EAR SIR: The article on page 242 of e Reclamation Era" of December , is most interesting and I would to obtain copies of the diagrams tioned in the last sentence of the cle.

you would kindly send me copies, would be much appreciated.

Yours faithfully,
H. L. HUME,
hief Designing Engineer, Ministry of Works, P. O. Box 24, Government Buildings, Wellington C. I., N. Z.

FALLS CHURCH, VA.

EAR SIR: Have read your very insting article on the Yuma Mesa er-purification systems. A very inous idea. Could you possibly send diagrams of the system. Particu- the germicidal lamp unit. ould be grateful. Thanks.

CLYDE HURST, JR.,
Mechanical Engineer.

AHOMA AGRICULTURAL
AND MECHANICAL COLLEGE,
Stillwater, Okla.

EAR SIR: Your article in the December issue of RECLAMATION ERA entitled na Homesteaders De-Bug Water is y enlightening. Many of our Oklana farmers have a pond as their y available source of adequate sup-

Ve are particularly interested in wing more about the details in conecting the cylinder casing with lamp t inside. Have you attempted to add automatic shutoff device in case lamp burns out?

Ve would appreciate any information you or your engineer, Mr. Collopy, ld supply us. We anticipate installseveral test sets in the near future.

Yours very truly,
ELMER R. DANIEL,
Assistant Professor.

Mr. Collopy informed Professor niel that a relay and solenoid oper- valve could be installed so as to t off the supply of water if the lamp led to operate. The characteristics the relay could be such as to serve ballast and would not require extra rent.—Ed.)

CANADA'S DEPARTMENT
OF AGRICULTURE,
Regina, Saskatchewan.

EAR SIR: In the December 1950 is- of the RECLAMATION ERA I read h great interest the article about the w compact water-treatment unit in e on the Yuma Mesa Division of the a project. I note that at the end of e article there is a statement that tes "Diagrams of the system may be ained by writing the District Maner, Bureau of Reclamation, Yuma, iz."

I would appreciate it very much if we could obtain from you the plans of this system as we have a very similar problem here at Outlook, Saskatchewan, on the Predevelopment Farm for the proposed South Saskatchewan River project, now under investigation by the Prairie Farm Rehabilitation Administration, Dominion Department of Agriculture.

Yours very truly,
D. W. KIRK,
Agricultural Scientist.

(All of the above correspondents and others whose letters we were not able to print due to lack of space received diagrams and answers to their queries. Mr. Collopy was frequently asked about the slim type of germicidal lamp. He states that if the slim type of lamp is selected, a smaller pipe of approximately 4 inches in diameter or a little larger could be used. The electrical characteristics of this germicidal lamp and its dimensions are the same as the ordinary fluorescent lamp and the same type of ballast and starter can be used.—Ed.)

Hungry Horse Gets an "A"

4513 BRANDYWINE,
Washington 16, D. C.

DEAR MRS. SADLER: Thank you very much for sending me copies of the RECLAMATION ERA. I made "A" on my Montana notebook and also "A" on my clay model of the "Hungry Horse Dam."

Your magazine added a great deal to my project.

Very truly yours,
STEPHEN VAN DYKE BAER.

(This is just one of the many services rendered by the RECLAMATION ERA, and represents the multitude of requests for information by students in the U. S. A. and abroad which are answered by our publication.—Ed.)

RELEASES

Reclamation Wall Map Available

A new vari-colored wall map showing existing and proposed Reclamation water resource developments in the 17 western States and Alaska is now on sale at the Superintendent of Documents, Government Printing Office, Washington 25, D. C. The price is $1 per copy.

Features of the new Bureau map graphically "spot" the 96 dams which store almost almost 83 million acre-feet of storage water, 35 power plants with over 3 million kilowatts of installed capacity, more than 16,000 miles of canals and 3,000 miles of transmission lines—all a part of the Reclamation program.

In addition to outlining Reclamation boundaries, regions, and headquarters, it also contains an inset key map showing the location of the 13 western river basin areas—the Missouri, Arkansas, Red, Gulf, Rio Grande, Colorado, Bonneville, Columbia, Lahontan, Southern Pacific, Central Valley, Central Pacific, and Northern Pacific. ●

Geographer's Study of Columbia River Basin

In the April 1951 issue of the Geographical Review, published by the American Geographical Society of New York, is an interesting and scholarly discussion of the Columbia River Basin under the title, "Rivers as Regional Bonds: The Columbia-Snake Example," by Edward L. Ullman, associate professor of regional planning, Harvard University. Dr. Ullman describes the Columbia-Snake River System, its transportation and population, new developments in irrigation, and the effect of new developments on the area-connecting role of the four main sections of the Columbia and Snake Rivers, which he terms "dioric" referring to streams crossing mountains, and "exotic" pertaining to rivers crossing deserts. Accompanying the study are photographs of the Columbia gorge, sagebrush lands, irrigated land, storage and power dams, and the Snake River Canyon, plus maps showing the Columbia and Snake Rivers in relation to mountains and deserts, the density of railroad passenger traffic, the density of highway traffic, the distribution of population, and present and proposed irrigated lands, the last-named map crediting the Bureau of Reclamation's map in "The Columbia River" as a source. All but one of the photographs were taken by Bureau of Reclamation photographers B. D. Glaha and F. B. Pomeroy. ●

NOTES FOR CONTRACTORS

Contracts Awarded During July 1951

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Cont amo
DS-3362	Davis Dam, Ariz.-Nev.	July 17	Cordless telephone switchboard equipment for Phoenix dispatchers' office.	Kellogg Switchboard & Supply Co., Chicago, Ill.	$14
DS-3379	Colo.-Big Thompson, Colo.	do	1 complete package-type switchyard, including power and distribution transformers, air switches, disconnecting fuses, fuse cutouts, supporting steel structures, and miscellaneous materials, for Willow Creek switchyard.	Industrial Electric Products, Inc., Phoenix, Ariz.	70
DS-3384	Davis Dam, Ariz.-Nev.	July 27	1 switchgear assembly and one 13.8-kilovolt circuit breaker removable element for Davis powerplant, schedule 1.	Westinghouse Electric Corp., Denver, Colo.	17
DC-3390	Central Valley, Calif.	July 20	Construction of Trauger pumping plant and high level distribution reservoir, Lindsay-Strathmore irrigation district, Friant-Kern Canal distribution system.	Stolte, Inc., and Fred J. Early, Jr., Co., Inc., Oakland, Calif.	709
DC-3394	Colo.-Big Thompson, Colo.	July 16	Construction of Willow Creek pumping plant and Willow Creek pump canal with monolithic-concrete pipe for siphons and pump discharge line, schedules 1 and 3.	Peter Kiewit Sons' Co., Denver, Colo.	1,287
DC-3398	Central Valley, Calif.	July 20	Construction of earthwork, pipelines, and structures for laterals 66.9W, 68.9W, and 69.8W and sublaterals, Ivanhoe irrigation district, Friant-Kern Canal distribution system.	United Concrete Pipe Corp., Baldwin Park, Calif.	636
DC-3414	do	July 16	Furnishing and installing additional distribution mains for Lindsay-Strathmore irrigation district, Friant-Kern Canal distribution system.	R. A. Wattson Co., North Hollywood, Calif.	624
DC-3415	do	July 20	Construction of earthwork, pipelines, and structures, including reservoirs and pumping plants, for laterals 74.6E and 77.3E, Unit 1, Exeter irrigation district, Friant-Kern Canal distribution system.	American Pipe & Construction Co., Los Angeles, Calif.	860
DS-3426	do	July 17	10 vertical-shaft turbine-type pumping units for pumping plants E1 and E2, laterals 74.6E and 77.3E, Unit 1, Exeter irrigation district, Friant-Kern Canal distribution system, schedule 1.	Food Machinery & Chemical Corp., Los Angeles, Calif.	27
DC-3430	Missouri River Basin, Wyo.	July 23	Completion of Boysen Dam, power plant, and switchyard	Flora Construction Corp. and Flora Engineering Co., Denver, Colo.	413
DS-3440	Fort Peck, Mont.	July 10	Four 115,000-volt circuit breakers, one 15,000-volt disconnecting fuse, and 3 potential transformers for Dawson and Williston substations, schedules 2, 3, 6, and 7.	General Electric Co., Denver, Colo.	110
DC-3444	Columbia Basin, Wash.	July 23	Construction of earthwork and structures for West canal and Frenchman Hills wasteway.	Peter Kiewit Sons' Co., Seattle, Wash.	433
DS-3447	Central Valley, Calif.	July 27	2 main control board extensions for two 69-kilovolt and four 115-kilovolt lines, and two 115-kilovolt and one 69-kilovolt transfer power circuit breaker circuits for Tracy switchyard.	Control Instrument & Engineering Co., Inc., El Paso, Tex.	30
DC-3456	Missouri River Basin, Wyo.	July 23	Construction of earthwork, structures, track, and communications line for relocation of Chicago & North Western Ry., Boysen Reservoir.	Peter Kiewit Sons' Co., Sheridan, Wyo.	163
DS-3458	Columbia Basin, Wash.	July 12	8 vertical-shaft turbine-type pumping units for Lake Lenore pumping plants Nos. 1 and 2.	Food Machinery & Chemical Corp., Los Angeles, Calif.	48
DS-3459	Cachuma, Calif.	July 25	One 36-inch butterfly valve for Lauro Dam outlet works	Premier Gear and Machine Works, Inc., Portland, Oreg.	11
DC-3463	Eklutna, Alaska	do	Construction of 30 two-bedroom temporary residences and utilities for Palmer, Alaska, and Eklutna government camp.	C. William Hufeisen, Anchorage, Alaska.	343
DC-3467	Davis Dam, Ariz.-Nev.	July 31	Completion of utility building and parking area at Davis Dam	Jack Willson, Downey, Calif.	141
602C-8	Missouri River Basin, Wyo.	July 9	Clearing part of Keyhole Reservoir site	Brasel Construction Co., Riverton, Wyo.	4

Construction and Supplies for Which Bids Will Be Requested By November 1951 [1]

Project	Description of work or material
Boise, Idaho	Generator voltage disconnecting switches and instrument transformers for Anderson Ranch power plant.
Buffalo Rapids, Mont.	Construction of drains and related structures for area No. 2, First Division, near Glendive, Mont.
Cachuma, Calif.	Construction of 12 miles of 36- to 27-inch concrete pipe conduit, part of the Carpinteria section of the South Coast conduit, near Santa Barbara, Calif.
Do	Construction of Tecolote tunnel control and chlorination house.
Do	Control piping, consisting of 36- to 46-inch diameter steel pipe, for Lauro distribution reservoir.
Central Valley, Calif.	Erecting 2 prefabricated metal buildings at Orland and Elverta, Calif.
Do	Two 9,400-horsepower at 40-foot head, vertical-shaft hydraulic turbines for Nimbus power plant.
Do	Two 8,000/10,000-kilovolt-ampere autotransformers with three 115-kilovolt and three 69-kilovolt lightning arresters, and one 69,000-volt step voltage regulator for Folsom switchyard.
Do	Two 5,000/6,250-kilovolt-ampere transformers for Folsom power plant.
Central Valley, Calif.	3 oil-pressure, actuator-type governors for 74,(horsepower turbines for Folsom power plant.
Colorado-Big Thompson, Colo.	Construction of 9.4 miles of 115-kilovolt transmiss line between Estes Park, Colo., and Pole I power plant.
Do	Main control boards, supervisory control and t metering equipment, and 125-volt distribut boards for Pole Hill power plant and Flati power and pumping plant.
Do	One 13,800/480-volt unit substation, one 460-v power distribution board, lighting transforn and battery charging and control equipment Flatiron power and pumping plant.
Columbia Basin, Wash.	Construction of Lower Saddle Gap, Upper Sad Gap, and PE 17 pumping plants and related late on Potholes East Canal.
Do	Modification of Pasco relift pumping plant n Pasco, Wash.
Do	Construction of Royal watermaster headquart and temporary construction camp in West Ca area, about 7 miles north of Corfu, Wash.

[1] Subject to change.

Construction and Materials for Which Bids Will Be Requested by November 1951—Continued

Project	Description of work or material
bia Basin, Wash	Construction of 7 permanent, wood-frame, 2- and 3-bedroom houses with private garages and utilities, at operation and maintenance ditchrider sites in lateral areas E-3, P-1, and P-2 near Othello, Wash.
	Drilling four domestic water supply wells for operation and maintenance ditchrider sites in lateral areas P-1 and P-2 and three wells in lateral area E-3.
	Motor control equipment for Lower Scootency pumping plant and Ringold pumping plant.
	One 1,000-kilovolt-ampere transformer for Ringold pumping plant.
	Drilling observation and drainage levels, placing perforated pipe, and installing hydrostatic pressure indicators for stabilization of Grand Coulee Dam right bank.
Dam, Ariz.-Nev	Constructing warehouse addition, area utilities, and street surfacing for system operation and maintenance area 3 miles west of Phoenix, Ariz.
eck, Mont	Conversion of existing Glendive pumping plant substation from 57- to 115-kilovolt operation and construction of 2 miles of 115-kilovolt tap line.
	Construction of prefabricated metal or concrete block warehouse and storage garage at Dawson substation near Glendive, Mont.
ek, Wyo	Construction of 12 two-bedroom wood-frame houses each with full basement and attached garage at Alcova Dam, about 32 miles southwest of Casper, Wyo.
	Construction of 1 mile of streets and construction of sidewalks, and sewage and water systems near Alcova Dam.
	2 oil-pressure, actuator-type governors for 26,500-horsepower turbines for Alcova power plant.
ton Orchards,	Construction of 30- by 80-foot warehouse near Lewiston, Idaho.
Rio Grande, ex.	Construction of 17 miles of Rio Grande River drainage and conveyance channel and levee from San Marcial, N. Mex., to channel headworks.
ka, Idaho	Three 15- by 17-foot fixed-wheel penstock gates for American Falls power plant.
ri River Basin, t.	Clearing section of Canyon Ferry Reservoir above Winston bridge.
	1 set of rails about 80 feet long for 70-ton gantry crane for Canyon Ferry Dam.
	1 main control board, one annunciator relay cabinet, one 1,500-kilovolt-ampere unit substation, one 460-volt and one 25-volt distribution boards, and battery chargers for Canyon Ferry power plant.

Project	Description of work or material
Missouri River Basin, Nebr.	Construction of 9.6 miles of 210- to 125-cubic feet per second capacity, unlined Cambridge Canal, 6.4 miles of drains, and 5 miles of channel changes; seeding 80 acres of canal banks; and construction of timber bridges, monolithic and precast-concrete pipe siphons, road crossings, and unreinforced concrete canal lining.
Missouri River Basin, N. Dak.	Construction of 1,500-kilovolt-ampere Custer Trail substation 8 miles southwest of Bismarck, N. Dak.
Do	Construction of 2,500-kilovolt-ampere DeVaul substation 11 miles southeast of Almont, N. Dak.
Do	Construction of 750-kilovolt-ampere Fort Clark substation for Fort Clark irrigation unit in central North Dakota.
Missouri River Basin, N. and S. Dak.	Fabricated galvanized structural steel for bolted steel towers for 115-kilovolt single-circuit transmission line approaches to Fort Randall Dam and Garrison Dam switchyards.
Missouri River Basin, S. Dak.	Construction of 5,000-kilovolt ampere Midland substation.
Do	Construction of 3,750-kilovolt ampere Philip substation.
Do	Construction of 2,000-kilovolt ampere Wicksville substation.
Do	Construction of 2,500-kilovolt ampere Wall Substation.
Do	Construction of metal or concrete block warehouses and storage garages at Armour, Sioux Falls, Watertown, and Philip substations.
Missouri River Basin, Wyo.	Construction of 50 miles of 115-kilovolt Lovell-Yellowtail transmission line.
Do	Supervisory control and telemetering equipment for controlling Lovell and Thermopolis substations from Boysen power plant.
Okanogan, Wash	Rehabilitation of Conconully Dam outlet tunnel and spillway crest and chute about 15 miles northwest of Okanogan, Wash.
Palisades, Idaho	Installation of vibration dampers on transmission line about 13 miles south to 56 miles southeast of Idaho Falls, Idaho.
Riverton, Wyo	Furnishing and applying asphalt lining on reaches of Wyoming canal, first division; 0.6 mile of Wyoming Canal, second division; and 15.5 miles of Wyoming Canal and 22 miles of laterals, third division.
Shoshone, Wyo	Construction of waterways for drains in the Heart Mountain division.

United States Department of the Interior

Oscar L. Chapman, Secretary

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Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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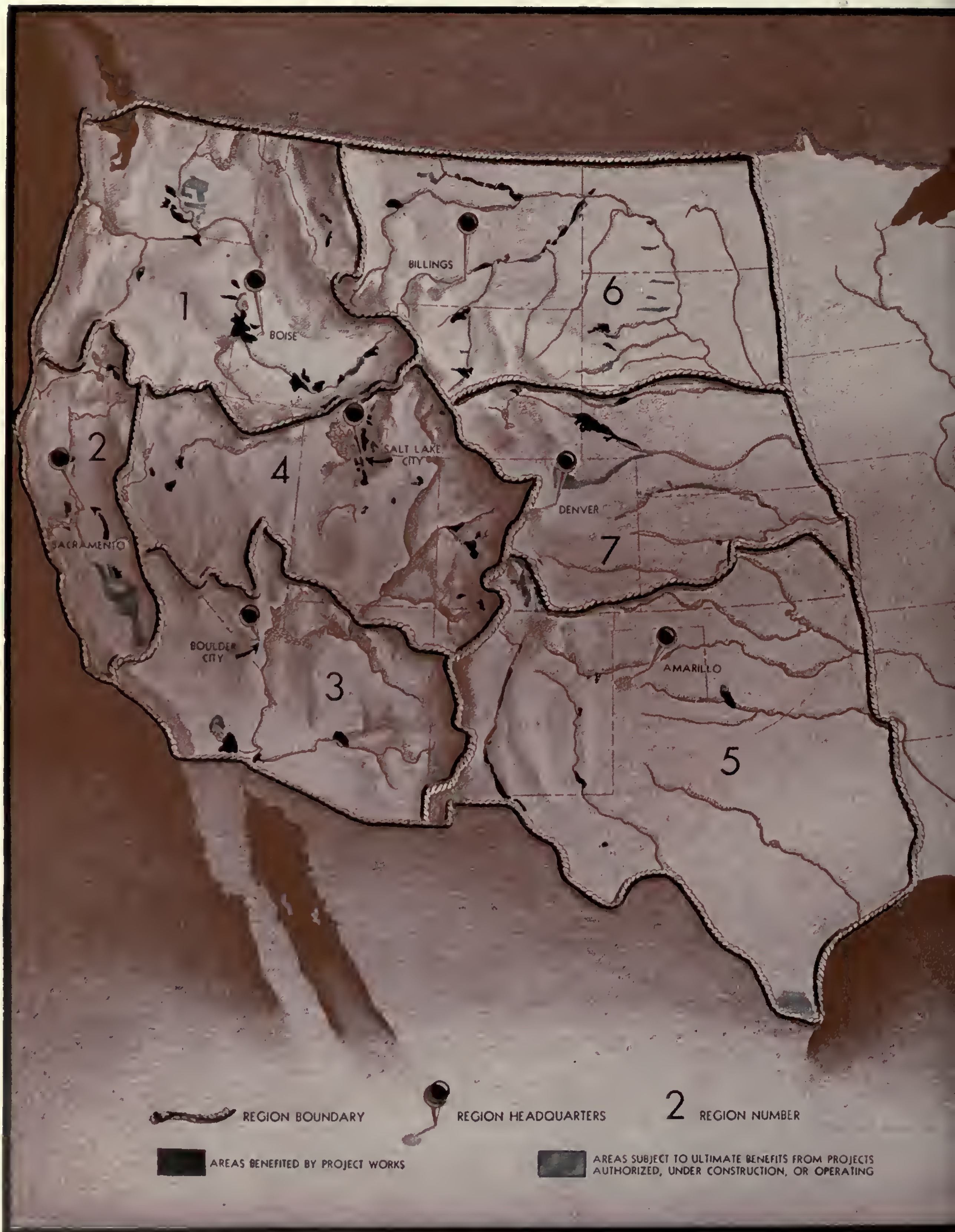

THE RECLAMATION AREA

The Reclamation ERA

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FEATURE ARTICLES

SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1.50 a year for persons residing in the United States and Canada; $2 a year for foreign subscriptions; special rate of $1 a year for members of water users' associations, and Bureau of Reclamation employees.

OUR FRONT COVER

King of the Crops

Often referred to as "King Cotton" the royal family is one of infinite variety. Our front cover photo by George O. Bonawit, Parker Dam Power Project photographer, shows a fine field of short staple cotton called X–44 near Coolidge, Ariz. This new type is said to yield approximately 2¼ bales per acre. Last year, farmers on Reclamation projects raised almost 112 million dollars worth of cotton—making this the most valuable single crop in terms of gross returns. Cotton of the Egyptian or upland type is raised in Arizona, New Mexico, and Texas, while California grows largely the Acala type. The yield of cotton was 1.4 bales of lint per acre, and over 5 tons of cottonseed per acre.

30 YEARS AGO IN THE ERA

We quote from a recent interview with I
Lucian W. Parrish, Representative from Te
the following:

"With an ever-increasing population the t
will soon come when America will find her
hard pressed to furnish homes and farms for
citizens and if we exercise the foresight of a
seeing people we will make ample provision
sane and conservative irrigation and reclama
of nonproductive lands.

"Money spent in this manner is not wasted
is wisely invested and will bring to the Na
a manifold reward in the way of homes fo
citizens and increased production."

(From p. 454 of the October 1921 issue of
RECLAMATION RECORD, predecessor of the REC
MATION ERA.)

RECLAMATION PLACE NAMES IN THIS ISSUE

America Needs All of Us

In cooperation with the President's Committee n National Employ the Physically Handicapped Veek ("NEPH WEEK"—October 7–13, 1951), nd in response to a request from the Chairman f the Committee, Vice Admiral Ross T McIntire MC), USN, Retired, we present these typical xamples of the part the Bureau of Reclamation s playing in offering opportunities to handiapped persons, on the farm, in the office, and on he construction job.

HUNGRY HORSE PROJECT

From the Hungry Horse project in Montana omes a heart-warming story of a tough, hardoiled construction outfit that is doing an outtanding job in employment of physically handiapped workers.

Hungry Horse is the fastest growing concrete am in the world. Set up originally on a drumead tight schedule, the job is being high-balled o get reservoir storage capacity and power genration at the earliest possible date to help supply he critical power requirements of Pacific Northest defense plants.

And the job has all the dangers inherent in onstruction of the world's third highest and ourth largest concrete dam. Working on a giant onstruction job like Hungry Horse Dam, a man eeds better-than-normal physical equipment—ot less.

But General-Shea-Morrison, prime contractor or the Hungry Horse Dam and power plant, has strong policy of employing physically handiapped men on jobs which they can handle. Mel Iord, assistant to Project Manager C. W. Smoky" Wood, is quick to point out that the olicy is the result—not of altruism—but of the nowledge that these men, when placed in the ight spots, frequently do a better job than men ith unimpaired physical faculties.

As you make the rounds of the job talking to nen who have been crippled by war, polio, tuberulosis, accidents, you find the reasons. They re simple, compelling reasons that should make

(Please turn to page 233)

BALL-BEARING swivel gives flexibility of normal wrist to cableway operator Ralph Olson (above). Welder Art Stratton has to watch that hook (below). *Top photo by A. E. McCloud, bottom by James Clausen, both of Region 1.*

FLOOD TOWN—Aerial view of Ellis, Kans., after June 22 flood. Note channel of Big Creek in center of photo. Old-timers said this was the worst flood to hit the area in forty years. At top are Rudy Walter, left, and Pilot Dale Corder, beside the Kansas River District plane. *Photos by John N. Berg, Kansas River District photographer, Region 7.*

AIR-BORNE FLOOD WARNING

by N. Beth Woodin
Kansas River District, Indianola, Nebr.
Region 7 (Headquarters at Denver, Colo.)

R. J. (Rudy) Walter, Jr., Construction En-neer for the Cedar Bluff Dam, Ellis, Kans., re-ntly enacted the role of Paul Revere—only in-ad of riding a horse ahead of the British rmy, shouting "The British are coming!", Mr. alter's "steed" was an airplane and his words re "The flood is coming!" And in contrast to ul Revere's midnight ride, Rudy Walter's ride s made at midday.

It all happened at the time Ellis and Hays, ans., were flooded on June 8, 1951. Big Creek, hich flows through both towns, is usually a acid 80-mile long tributary of the Smoky Hill ver. The flood of June 8 was the second time ithin a few weeks this creek had gone on a ram-ge. Previously about midnight on May 22, 1951, unusual flash flood of about 20,000 cubic feet r second roared down the creek, hitting Hays, ith its population of approximately 6,000, caus-g a property damage of over a million dollars d snuffing out 6 lives. This flood did not hit llis as it is some 13 miles above Hays, and the rst of this flood, caused by a record downpour 11 inches in 30 minutes, occurred between the o towns and near the small town of Yocemento. uring this downpour 2.34 inches fell at Ellis here Rudy Walter's office is located in the base-ent of Ellis city hall.

After the disastrous Hays flood in May, several ins fell in the area. It poured Wednesday night, une 6. The next morning the mayor of Ellis d other city officials told Mr. Walter that a port had come to them that Big Creek was nning 2 miles wide below the town of Quinter, miles upstream from Ellis. The mayor id that they had no regular flood warning stem; they depended entirely upon word-of-outh information to warn them of impending gh water. It was impossible for the city officials verify the rumor by telephone because the lines the west were out as a result of the violent storm f the preceding night.

It happened that the Kansas River district plane as in Ellis at the time. The plane had come in that morning from the west over the upper reaches of the Saline River and the North and South Forks of the Solomon River, and Pilot Dale Corder reported that all of these streams were out of their banks. After instructing members of his staff to stand by for messages and to get the office records and other irreplaceable Government property ready for evacuation, Mr. Walter enlisted the aid of Pilot Corder, and taking a man from his office along to take aerial photographs, the three flew up Big Creek to its source.

They spotted the crest of the flood about 2 miles west of U. S. Highway 283 south of Wakeeney, Kans. The creek was out of its banks and was approximately one-half mile wide in places. Mr. Walter flew back to Ellis and confirmed the rumor. A flood *was* approaching, and this time it looked as if it would top the banks of Big Creek at both Ellis and Hays. Phoning the warning to Hays, he promised officials of both towns that he and his staff would get more definite news on the flood's severity and time of arrival, and would keep the city officials informed.

Through another lucky circumstance, when Mr. Walter went downstairs to his office, there was A. J. Ferrin, hydrologist with the United States Geological Survey, waiting to discuss some matters regarding gaging stations for Cedar Bluff Reservoir. In view of the emergency, they put a call through to the Survey office in Topeka, got an okay for Ferrin to postpone the scheduled business and help Walter. Ferrin drove over to Wakeeney Bridge to measure the stream flow. By that time Big Creek was flowing 3 feet over its banks. Ferrin rushed his instruments and readings to Walter's office where he and his staff figured out a "time table" for the flood, from Ferrin's stream measurement, their own knowledge of the area, observations made from the plane, and charts which measured river miles. According to their calculations the flood would reach Ellis at 4 a. m. early the next morning, Thursday, June 8, and by the time the flood reached Ellis, Big Creek would top its banks by 1 foot.

For on-the-spot checking, Mr. Walter stationed a man at the Riga Bridge between Wakeeney and Ellis to make periodic readings and reports to Walter's office.

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THE PEOPLE'S PIPELINE AT PASCO

by PAUL N. BICKFORD

**Chief, Domestic Water Systems Unit, Columbia Basin Project, Wash., Region 1 (Headquarters at Boise, Idaho

DOMESTIC WATER PROBLEMS may be a cinch some places—but not on many of our Reclamation projects. Even the practices of that ancient art of "water witching" meet with failure in the Columbia Basin project. Mostly the water is deep and often protected by several layers of extra-hard basalt.

The early settlers of Irrigation Block 1, living about 15 miles northwest of Pasco, Wash., have had their share of ups and downs in getting water into their homes. It is about 200 feet to water which means a cash outlay of close to $1,500 for a well and pressure system. A few had this kind of money but most of them needed every dime they possessed to build a shelter, buy farm equipment, seed, and some livestock. Essentials like domestic water had to go begging.

In the meantime the Bureau of Reclamation had drilled a well for the Pasco development farm and provided an outside hydrant for the convenience of water haulers. Out of this grew all types of conveyances from milk cans to surplus wing tanks mounted on trailers. Typical is figure 1, as Mrs. Scotty Getchell "pours." Such unhandy arrangements have been natural spurs to the desire of housewives to have a modern water system under pressure. Consequently the settlers started early to obtain such a system. An attempt was made to establish a local improvement district under the South Columbia Basin Irrigation District. This died an unhappy death because of changing personnel on farmsteads, rising costs, and opposition to the idea.

By the end of 1949 enough of the settlers were of one mind and a committee was formed for studying the situation. This original committee was under the leadership of E. D. Patterson, one of the settlers. He, with a lot of help from secretary Scotty Getchell, got 40 of the farmers to wor together and form the Pasco Heights Domesti Water Association, incorporated under the Stat laws of Washington.

The Association applied to the Farmers Hom Administration for a loan to construct a com munity water system. It was granted. Th FHA engineers designed a water system for the 4 members, using the Bureau-owned well at th Pasco development farm as a source, it bein leased for the purpose.

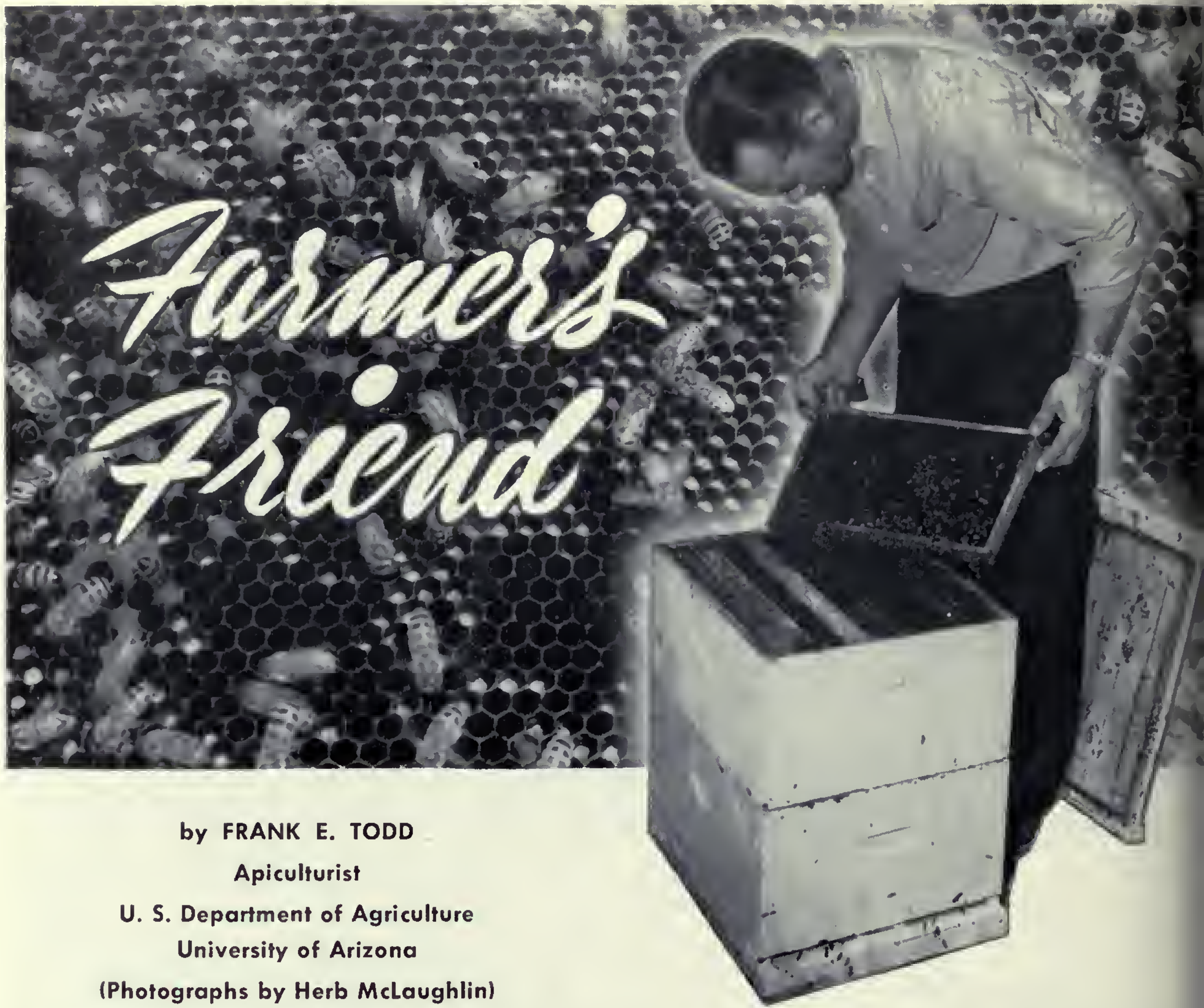
By late spring of 1950 it looked like water i the houses was assured, but before bids could b received, came Korea. Almost overnight, wate pipe seemed to disappear. But largely throug the tenacious determination of secretary Scott Getchell, and with the help of some local news paper publicity and the research of various cham bers of commerce, enough pipe was discovered t do the job.

A contract was let late in the fall and despit various delays, by the middle of June this yea water was delivered under pressure in all th homes of the association members. It has bee good digging on the job. Figure 3 shows the ri that did most of it, and figure 4 shows pipe lai in the trench. In this case it was laid up to th main irrigation lateral, before auguring a hol underneath to make the crossing. It has take quite a while, it is true, but it has been accom plished in the good old American style, by direc representation of the people. Figure 2 is a pictur of the group, all settlers in the area, who kep plugging away until they got what they wanted

A great deal has been learned from the experi ence of getting domestic water to the Pasc Heighters. It was found that it takes a lot o meetings to get people to think along the sam ıes. It takes quite a bit of heavy money (about ,350 per unit in this case), but through the FHA ey get 30 years at 3 percent interest to pay out. will take a tremendous amount of financing ıd planning to get water to the thousands of set- ırs who will pour into the Columbia Basin from 52 on. It is a whale of a big undertaking; too rge for one agency to handle. Realizing this e Bureau of Reclamation has entered into a co-

(Please turn to page 229)

ITY THE PASCO HOUSEWIFE (1) before the domestic water ystem was inaugurated. This is how Mrs. Scotty Getchell and thers "poured." (2) They were saved by the Pasco Heights)omestic Water Association Committee, left to right, Harry Bair, d Mosebar, Frank Shaw, Mrs. Getchell, Bill Lavercheck, Max ard, and Scotty Getchell. (3) They dug ditches for the water ystem. (4) This is how the pipe was laid in the trenches. Robert). Tschirky residence is in the background. *Photo by Ellis Short- ill, Columbia River District photographer, Region 1.*



by FRANK E. TODD
Apiculturist
U. S. Department of Agriculture
University of Arizona

(Photographs by Herb McLaughlin)

ALTHOUGH THERE ARE NUMEROUS solitary bees native to Arizona, honey bees were brought by the white man. (The solitary bees build individual nests, do not live in colonies, and produce no honey at all and only enough nectar and pollen for their own use.—Ed.) The first honey bees, which the Indians called the "white man's flies," reached Arizona 234 years after their arrival in New England from Europe in 1638. Honey bees first reached San Francisco by boat from New York in 1853 and from the San Francisco-Sacramento area to San Diego in the early 60's. In 1872 Gen. J. B. Allen moved two swarms by wagon through the 500 miles of mountain and desert from San Diego, Calif. to Tucson. Thus did honey bees reach Arizona, and a new industry of ever growing importance was born.

The first two swarms to issue from General Allen's colonies were sold to L. C. Hughes of Tucson, who, during the next 2 years, increased them to 15 colonies. Many swarms from these were distributed during the early 80's to residents throughout the southeastern part of Arizona. (For these historical notes we are indebted to the Honorable Senator Carl Hayden.) According to the census, the industry had grown to 19,000 colonies at the turn of the century, and now, 50 years later, there are about 65,000 colonies in the State.

Many people are surprised to find an abundance of nectar-yielding flora in the desert. The early honey crops undoubtedly came largely from such native plants as mesquite, catclaw, and cacti, but cultivated plants were destined to grow in importance. Alfalfa was introduced into Arizona from California probably in the early 80's and its use spread rapidly in the agricultural valleys. Official records indicate that alfalfa contributed nearly half of the 1918 honey crop, and cotton ly 3 percent. The desert still supplies two-ths, alfalfa one-third, and cotton one-fifth of e annual Arizona honey crop. Thus, during e past 30 years, cotton has become an impor-nt honey source. Arizona honeys are distinc-e. Many people prefer the rich flavors of esquite and catclaw honey, while others enjoy e spicy flavored alfalfa honey.

The development of bee culture has made a ore important contribution to the State's re-urces than just the honey crop, for it provides llination service for agricultural crops and nges. The alfalfa seed, cantaloupe, water-elon, and vegetable seed industries are largely pendent upon bees for pollination. Cotton pro-ction is probably aided, although this needs rther clarification. The value of the produc-n of these agricultural crops far outweighs the lf million dollar annual returns from honey d beeswax.

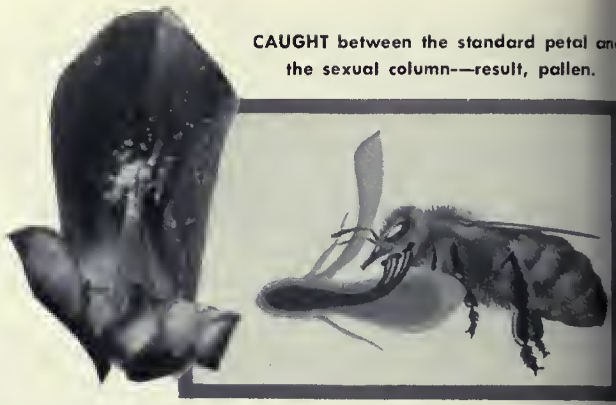
Flowering plants for the most part require an ternal agent to transfer pollen (the male ele-ent) to the stigma (the female part of the ower) before the ovule or egg can be fertilized d develop into seed and fruit. When plants such alfalfa or melons are screened to prevent bee sits to their flowers—no seed or fruit is produced. bees are introduced into such an experiment to rve as pollinating agents, the productivity of the me plants becomes so great it amazes the experi-enter. The honey bee is a hairy creature and hen it visits a flower to obtain nectar pollen, ains become entangled in these hairs. Flowers are so constructed that the visiting bee will rub some of the pollen on the stigma. On a food-collecting trip the bee visits only one species of plant and carries pollen from one plant to another, thus accomplishing the cross pollination necessary to maintain vigor in the offspring. The bee is interested in collecting food, but its visit to the flowers renders an indispensable service to plants.

The pollination of alfalfa has been intensively studied during and since the war because of an acute shortage of seed which could not be augmented by millions of dollars of subsidies or any other known means. An amazing discovery has recently been made which may revolutionize seed production methods. Scientists have, for many years, credited certain native bees with a major role in the pollination of alfalfa. Recent studies, however, have shown that in the principal seed producing areas of the West, honey bees are doing most of the pollination work for which native bees had been given the credit. The importance of this discovery lies in the fact that the seed grower need no longer leave pollination to chance, because honey bee colonies can be concentrated when and where they are desired. This cannot be done with native bees. By providing additional honey bee colonies, seed yields have been increased twofold and threefold over those obtained by the older method of leaving pollination to chance.

In newly cultivated areas of Arizona, alfalfa seed yields of 1,000 pounds or more per acre were

PORTANCE OF HONEY BEE IN SEED PRODUCTION is proved expert studies and experiments, resulting in great benefits to rmers, beekeepers and merchants.

TRIPPING an alfalfa blossom. The bee inserts its head into the blossom.



CAUGHT between the standard petal an the sexual column—result, pollen.

obtained—but the cultivated acreage increased, and a greater demand arose for pollinators. The impact of agricultural development on native bees is severe, as their nesting sites in the soil are destroyed and insecticides kill the adults. On the other hand, honey bees are husbanded by man, and although they may be severely affected by insecticides, their numbers in the State have been maintained and increased more than fivefold during the past 50 years. This probably explains why native bees have declined in importance, while the honey bee industry has become an indispensable part of our agricultural economy.

Only a fifth of the 200,000 acres of alfalfa in Arizona is used for seed production. The seed acreage is definitely localized to Yuma County and in the Buckeye area of Maricopa County. These are the areas having the highest concentration of apiaries, but this coincidence has been overlooked until recently. In other parts of Arizona, seed yields have been unaccountably too low for profitable production, but the recognition of the honey bee as a pollinator may help to extend the seed-producing area.

The alfalfa flower is a classic example of a perfected floral structure designed to effectuate cross-pollination. It has an explosive pollinating mechanism which acts like a trap for bees. When the bee extends its proboscis into a flower, with its head pressed against the standard petal, a tripping mechanism is contacted which opens the keel and releases the sexual column. The tip of the sexual column bears the pollen-yielding stamens and a stigma. When released, this column springs forth explosively, striking forcefully the lower rear portion of the bee's head where it deposits a mass of pollen. The bee's head is pinched between the standard petal and sexual column, and when pulled free it still bears a pollen mass. Sometimes this "explosion" is so forceful that i actually can be heard and on rare occasions th bee is unable to extricate its head. Cross-pollina tion is accomplished by repeating this perform ance in the next flower visited, the stigma bein embedded in the pollen mass from the previou flower until the bee frees its head. Until th flower is tripped, the sexual column is hidde within the keel, but, after tripping, it remain exposed to view, pressed firmly against the stand ard petal. Within a few hours the petal wrap around the sexual column and wilts, giving a fiel of rapidly tripped flowers a brownish cast. A field with few tripped flowers has a solid bluish purple cast resembling a flower garden.

The pollen-gathering bee transfers polle caught in its body hair to "baskets" on the outsid of its hind legs. When a full load is collected, i is carried back to the hive where it is fed to youn bees and eaten by nurse bees to be converted int royal jelly. Pollen supplies the colony with th protein, minerals, and vitamins necessary in th bee's diet, while nectar supplies the carbohydrate To obtain a load of pollen, the bee visits about 35 flowers.

Some idea of the size of the task of pollinatin Arizona's alfalfa seed crop may be gained by a estimate of the number of flowers involved. Abou 400 million flowers are borne by an acre of alfalf grown for seed and these will not produce see pods unless tripped and cross-pollinated. At thi rate the average 38,000 acres devoted to seed i Arizona would provide 15 trillion flowers to b visited during a 4-weeks' flowering period by a field force of about 1.5 billion honey bees in th State. Of course, not all colonies are located i seed fields. It is not surprising that investigatio indicates a deficient supply of pollinators, and tha

(Please turn to page 229)

FIRST LINE OF DEFENSE against drought is the new diversion dam, above, recently completed by the Bureau of Reclamation for the Fort Sumner, N. Mex., irrigation project. At left, a section of the main canal, near the city of Fort Sumner.

FORT SUMNER FORTIFIED

FOR THE FIRST TIME in the 87-year-old irrigation evelopment in the Pecos River Valley near Fort umner, N. Mex., farmers now have a dependable ystem for spreading Nature's capricious supply f water over their croplands. Construction of new diversion dam and rehabilitation of the anal and drainage facilities have been completed y the Bureau of Reclamation (see article entitled, "Fortifying Fort Sumner" on page 74, pril 1950 issue, for background material).

Without fanfare or any sort of ceremonies to nark completion of the building program, farmrs have tapped the distribution canals to send vater flowing over their cultivated lands and astures. The Bureau of Reclamation's engineerng staff, with the exception of a small force to irect cleanup work, has been transferred to ther jobs in western river basins.

Abraham Lincoln was president of the United States when the first irrigation development came nto existence at Fort Sumner, the settlement esablished in honor of E. V. Sumner, commander f the Ninth Military Department in New Mexico. The first irrigators there were Navajo Indians vho abandoned the experiment in 1868.

Interest in an irrigation project in the area was evived in the early 1900's, a period of heavy vestward migration. However, a lack of adequate engineering, coupled with floods, resulted in severe damage to the diversion works and waterlistribution system. Subsequent attempts to place the project on a sustaining basis were marked with failure. In the late 1940's, property owners requested the Bureau of Reclamation to investigate the valley's problems, and design and construct a system to serve the 6,500-acre project. Irrigation district directors signed a contract with the Federal Government in 1949 to repay construction costs, and the Reclamation Bureau began its building program in 1950.

Work performed by the Bureau includes a new diversion dam, 150 feet downstream from the original structure, 3 miles northwest of Fort Sumner; enlargement of the canal system; installation of a pumping plant to deliver water to the project's high line canal; and rehabilitation and extension of the drainage system. The diversion dam is 50 feet high, with a crest length of 650 feet. Much of the main and high line canals is concrete lined.

A unique feature of the project is the pumping plant. The power required for raising water from the main canal to the high line canal is obtained without cost. The power is generated by dropping water 11 feet at one point in the system. Power created by this drop is used to pump the water to a height of 12 feet from the main canal into the high line canal.

Principal crops grown on the Fort Sumner irrigation project include alfalfa, corn, grain sorghums, vegetables, apples and grapes. THE END.

FOR THE GOOD OF THE LAND—The definition of "Bonifica"—under the E. R. P. (Economic Recovery Program) of the ECA, road-building goes on at the Destra Sele, or Right Sele reclamation project near Salerno. The rock base is 20–25 centimeters thi Each man working on the irrigation canal for this project mov an average of 4 cubic meters of earth each day—see photo abo

Reclamation under the Marshall Plan in Italy

by W. E. CORFITZEN, Reclamation Specialist
Economic Cooperation Administration, Rome, Italy

PART 3

COSTS AND BENEFITS OF THE PROGRAM

EDITOR'S NOTE: In part 1—How the Program Began, and Part 2—the Working Plan, Mr. Corfitzen dealt with the background of the plan for rapidly improving the Italian national economy through reclamation development, including comparisons between the problems of the United States and Italy, and the manner in which the programs were developed. In this issue, he points out the cost of the projects and the benefits which the Italian people have received, or will receive, as a result of reclamation work in that country.

THE ANTIMALARIA PROGRAM is being carried out by the High Commissioner for Hygiene and Public Health with funds furnished by ECA through the Ministry of Agriculture and includes 115 districts in 28 provinces of Italy, involving approximately 1,400,000 people. While no land is directly improved through this program, there is no doubt that the indirect benefits, although difficult to assess, are extremely large. Since the summer of 1948, approximately $400,000 has been made available to carry on this work.

The War Damages program which has been ap proved by the Mission involves an expenditu of approximately $4,500,000 for the rehabilitati of farm roads, culverts, irrigation and draina ditches, bridges, telephone lines, etc., destroyed damaged on Italian reclamation projects by mil tary action. Part of the damage was due to t wear and tear occasioned by military traffic wh other damage was caused by explosion, some ac dental and other intentional, as in the case bridges destroyed by retreating troops. For th category there was a lump sum allocated to used on 103 specific projects.

The Mountain Basin projects involved a pr posed expenditure of approximately $7,000,0 during the first year of ECA assistance. Only very small part of this problem was approved b cause after examination it appeared to Missi investigators that immediate benefits would n be commensurate with the proposed expenditur Accordingly, after agreement with the Minist of Agriculture, the unallocated balance tentative allocated to the Mountain Basin program w transferred for use on the Acceleration and Co centration A categories. A total of 652,180,0 lire ($1,043,504) has been approved for 46 pro ects in this program.

Although 42.6 billion lire ($70,000,000) was a

Italy: Estimated Benefits of ERP Counterpart Land Reclamation Program

[4-year program]

Item	Quantity			
	Metric units		English units	
›wly irrigated land	Hectares	409, 000	Acres	1, 100, 000
›igation canals	Kilometers	8, 950	Miles	5, 560
›igation water supply	Liters/sec	440, 500	Acre ft./day Cu. ft./sec	6, 250 12, 500
›claimed land	Hectares	335, 000	Acres	828, 000
›ainage canals	Kilometers	2, 880	Miles	1, 790
ımping stations	Number	44	Number	44
ırth filling	Hectares	800	Acres	1, 980
›forestation	Hectares	27, 000	Acres	66, 700
ınd protected from flood	Hectares	164, 000	Acres	405, 500
ver control	Kilometers	1, 570	Miles	975
›ads	Kilometers	4, 100	Miles	2, 550
›idges	Number	480	Number	480
ırm buildings	Number	17, 000	Number	17, 000
ımily group houses	Number	19, 000	Number	19, 000
›inking water supply	Liters/sec	1, 200	Gals. daily Gals./min	27, 360, 000 19, 000
›ople supplied with drinking water	Number	410, 000	Number	410, 000
›ectric power:				
Installed capacity	Kilowatts	30, 000	Kilowatts	30, 000
›ople supplied with electric power	Number	330, 000	Number	330, 000
›orking days employed in the implementation of works	Number	70, 800, 000	Number	70, 800, 000
›orking days per year employed in more intensive cultivation (permanently).	Number	30, 900, 000	Number	30, 900, 000

›cated for the reclamation program during the ›st year of ECA operation, the development of a ›ogram of acceptable projects took some time and ›alian finance procedures made it impossible for ›e Ministry of Agriculture to allocate counterpart ›nds until enabling legislation was passed. Such ›gislation was enacted on April 23, 1949, and work ›as thereafter authorized on the projects thereto›re approved by ECA.

The development of construction organizations ›ı the various projects took some time and it be›me evident that the funds originally contem›lated for expenditure during 1948–49 would be ›fficient to carry on construction during 1949–50. ›ccordingly, no appropriation was made for the ›ricultural program in 1949–50.

During the past few months there has been cre›ed within the Government an organization ›ıown as "Cassa per il Mezzogiorno" (meaning ›Fund for the South"), which has the responsi›lity of developing agriculture, expediting con›ruction of all reclamation projects in Southern ›aly, and also developing the tourist industry. ›he Parliament has also enacted a law known as ›e "Cassetta Law," which provides for expediting ›e development of depressed areas in North-Cen›al and Northern Italy. Consequently, from now on the reclamation projects of ECA, formerly entirely within the Ministry of Agriculture, will be under the Ministry of Agriculture, the Cassa or Cassetta, depending upon the location of the proj-

PRECAST CANAL LINING BLOCKS are set in the irrigation canal on Brian project in the Veneto region of Northern Italy.

ects. The Counterpart Lira Fund is building up and funds will be made available to carry on construction of the Acceleration, Concentration A and Antimalaria projects as soon as the budget is worked out by these agencies for 1950–51 and 1951–52.

As of December 31, 1950, the reclamation projects had furnished 4,448,000 man-days of work. Time has not been available to assess exactly the benefits already achieved by the works undertaken, but some idea of the magnitude of the benefits anticipated may be seen in the table on page 223. Mission investigators are now examining certain new features which are being proposed on various projects already under construction and as these investigations are conducted, opportunity is taken to check on the amount of work already completed and the benefits achieved.

In a land of limited area, with an estimated population of 46,600,000 and with 2,000,000 men presently unemployed, the item of most interest to the Italian people is the fact that about 71,000,000 man-days of labor will be required to complete the works started with ECA funds and that upon completion lands will be developed to the extent that 120,000 men per year will be furnished work in the fields in addition to those already employed. To the trained agriculturist and economist, hope lies in the fact that over a million acres of land will be brought under irrigation while over 800,000 acres will be reclaimed from swamps to add to the internal food supply of Italy, which is so sorely required. THE END.

Air-borne Flood Warning

(Continued from page 215)

Mr. Walter and members of his staff stayed on duty all night and the next day, reporting the progress of the flood to city officials in Ellis and Hays and to Radio Station KAYS at Hays, which made hourly broadcasts throughout the night. The flood hit Ellis at 4: 10 a. m., only 10 minutes later than the time estimated by Mr. Walter, and Big Creek topped its bank by 1 foot, exactly as estimated. Water ran through the streets of Ellis anywhere from knee to waist high. Hays was hit by the flood waters 12 hours later, at 4 p. m., June 8. Not until after the flood had passed Ha did Mr. Walter and his men leave the job.

Because of the adequate warning of the ap proach of the flood given the people of Ellis an Hays by Mr. Walter, property damage was he to a minimum and no lives were lost. The bas ments of 50 homes in Ellis were flooded and pro erty damage was estimated at $5,000. Residen had ample time in which to remove their posse sions from the basements and first floors of the homes, thus holding the amount of property dar age to a minimum. Because residents of Ha had not completed the cleaning up of their hom after the May 22 flood and the same area was l on June 8, no estimate of the property dama was made at Hays.

The people of Ellis and Hays were grateful Mr. Walter. When Reclamation's Commission Michael W. Straus arrived in Ellis on June 10 take part in the dedication ceremonies for t Cedar Bluff Dam, they told him what Mr. Walt had done. Commissioner Straus casually me tioned in his address at the dedication ceremoni that if the people of Ellis or Hays ever need any expert flood forecasting done, they need on call on the Cedar Bluff field office of the Burea of Reclamation.

As an interesting aftermath of this story, th is exactly what they have been doing since t Commissioner's visit. Severe rainstorms co tinued throughout June, and being fully conscio of the disaster a flood can cause, the townspeop have kept Rudy Walter and his staff busy inves gating reported high water after every rainstor of any proportion that has occurred since the Flood conditions following heavy rains on Ju 10, June 21, and June 26 were checked by t Cedar Bluff field office. These rains caused overflow at Ellis or Hays, but a flood of ev greater severity than the May 22 Hays flood c curred on June 22–23 at both Ellis and Ha (Big Creek is not one of the streams on which t Bureau is working, and only very sketchy recor exist prior to the June 8 flood for compariso However, old-timers say the June 22–23 flood w the worst in 40 years.—Ed.) This time, howev both towns were adequately warned. No liv were lost and the property damage was much le than in May, thanks to Rudy Walter and h staff. THE EN

FARM AND PHEASANT


Photo by Stanley Rasmussen.

Idaho's reclaimed areas provide sanctuary for wild birds and sport for hunters

by O. M. BROWNE
Assistant Regional Planning Engineer, Region 1, Boise, Idaho

The pheasant, because of irrigation, is in Idaho to stay.

This regal bird has been in the State about 43 years and its presence is mutually satisfactory to man and bird—to the pheasant because of the food, water, and shelter provided throughout the extensive irrigation belt, and to Idaho people because the bird offers some of the finest hunting found anywhere.

A lion's share of the State's bird acreage lies in southern Idaho. There the Chinese pheasant and its close relatives, the Mutant and the Mongolian, inhabit tangled cover along ditchbanks, unused corners of irrigated fields, strips of border land between cultivated fields and sagebrush desert, and, of course, the fields of corn, beets, alfalfa, and other crops. Wherever there is something to eat, a supply of water within reasonable distance, and cover in which to take refuge when the fall artillery blasts start, Mister Pheasant is a prominent resident.

The Idaho Fish and Game Department figures there is about one bird to every three acres of irrigated habitat, where without irrigation there would be none, or hardly any. Some 2½ million acres of land are irrigated in the State.

The Idaho figures are supported by data from nearby eastern Oregon projects. On the 32,000-acre Vale development, for instance, the Oregon Game Commission found, on the basis of a 4-year study, an average of 38 pheasants per 100 acres. The same study found a similar proportion on the nearby 100,000-acre Owyhee development.

Idaho's hunting paradise is not necessarily duplicated wherever there is irrigation. Altitude is an important factor. If the zone is high, the winters long, and the springs generally wet and cold, the pheasant has hard sledding.

Although there is no way of telling down to the last bird precisely how many pheasants there are in Idaho, Maurice Lundy, bird supervisor for the Fish and Game Department, estimates the Idaho population at about 1,500,000 in an average year. Hunters get approximately one-third of the lot each season. The daily bag and possession limit is two roosters. In 1949, western Idaho, the cream of the hunting area, had a limit of three, plus a day or two of hen shooting in certain localities. Tightening of the limit is not so much an indication of fewer birds as it is an increase in hunters.

The best information the game department has been able to discover credits introduction of pheasants in Idaho to a barber named Ed Foster, who brought a few to the Twin Falls tract near his home town of Buhl in 1907. This was about the

HUNTER'S PARADISE, ob
hee reservoir in Oregon,
duck-hunting area create
eral reclamation constru
left, the author, O. M
with his black Labro
"Mucho" who, besides
a profitable pastime for h
has managed to take t
in western field trials.
right, Tex Everhart and E
exhibit some of the phea
shot, proving that south
and eastern Oregon o
hunting grounds. ***Photo b***
Rasmussen, Region 1 phot

time Federal Reclamation was getting a foothold on the Minidoka project.

Chinese pheasants depend on civilization—a paradoxical situation. Civilization, as represented by an army of hunters, does its best to wipe out pheasants every fall. If it were not for man there would be a thumping big flock of birds. On the other hand, if it were not for the crops men raise—mostly on land that has been reclaimed from sagebrush—Idaho would be as bare of the species as it is of the kangaroo.

The pheasant is a semi-domestic customer. The chief feed is by-products of farming. Some farmers say that the pests don't confine themselves to by-products, by jimminy. They pick up a little corn seed, get into field crops, and once in a while their exploring beaks work over a watermelon patch. On the whole, however, the damage pheasants do is offset by their destruction of insects.

Ideal pheasant country, sportsmen say, is to be found on stretches of irrigated land adjoining unbroken stretches of raw desert. Birds come down to the canals and hay fields to nest. They raise their young in the proximity of good food supplies. Fence rows that are not skinned bare afford them cover in the fall when the shooting starts. Large numbers are also flushed from the coarse growth along reclamation canals that serve the dual purpose of hiding place and source of water.

The advantage of the nearby sagebrush, as far as the birds are concerned, is as a refuge. It is a habit of the sensible creature to vanish into the wilderness when the bombardment starts. He makes use of his wings to get into the brush, and then he runs around all day playing games with hunters and dogs. In the evening the pheasant drifts back to the crop land for rations, and a roll call of his remaining relatives.

Whether it is a coincidence or a rule that can be regarded as reliable, newly broken reclamation projects seem to provide better pheasant country than some of the old and established tracts. About 2 years after cropping is started, the birds take foothold. Perhaps they like to pioneer, or believe the human beings on the new project will be more friendly. At any rate, hunters who have combed a

lot of Idaho are commonly anxious to try their luck on a brand new project.

Take, for example, the Black Canyon tract on the Boise project, between Caldwell and New Plymouth. Fifteen years ago there wasn't a healthy magpie on the desert, let alone a game bird. Today the water has come, and with it farming and beneficial wildlife. Pheasant cover is good because there are many parcels of land only partially cultivated. On some slopes the vegetation is coarse. Annual weeds remain in jungled profusion. That may not be good for agriculture, but it is great medicine for Mr. Pheasant. As necessary improvements are made and his habitat is less advantageous, the bird will continue to find a happy home on an irrigated farm. Only he will spread himself a little thinner, as he has in the past, when row cropping and the improvements of smart agriculture have stepped close to his tail feathers.

Water has been important not only to pheasants but in the encouragement of quail and other game birds that are to be found on many Idaho tracts.

The suitable habitat provided by such artificial lakes as Lake Lowell on the Boise project (once called Deer Flat Reservoir) in Canyon County is credited by wildlife officials with a major part in influencing the flight of waterfowl. Millions of ducks and geese visit the lake every fall. The local duck population is increasing because more and more of the migrants find conditions to their liking in normal years. They go no farther south. Large numbers remain to nest along the rivers of western Idaho. The reservoir is an assembly and distribution point for a considerable portion of all the ducks in the area. Without it far more ducks would fly on south without pausing and hunting would not be up to the present level.

Yes, Federal Reclamation and wildlife conservation have purposes in common. THE END.

MILLIONS OF CANADA GEESE and other waterfowl use Lake Lowell (once called Deer Flat Reservoir), the Bureau of Reclamation reservoir on the Boise project in Idaho as a winter refuge. Some remain to nest. ***Photo by Bus Howdyshell, Pendleton, Oregon.***

Peoples Pipeline at Pasco

(Continued from page 217)

erative agreement with the Agricultural Exten-n Service of the State College of Washington at illman, and the Farmers Home Administration ereby technical studies are made of all irriga-n blocks and detailed estimates of costs deter-ned. Consequently, when the potential settler eks information about domestic water his ques-ons will be answered by a well-studied plan that ll point the way to orderly development of do-estic water facilities. THE END.

FARMER'S FRIEND

(Continued from page 220)

is necessary to increase the number of colonies tending alfalfa fields from one per acre, which profitable for honey production, to five or six obtain seed yields of a thousand pounds or more r acre.

The construction of the alfalfa flower permits e collection of nectar without tripping. The bee serts its proboscis between the overlapping wing d standard petals, avoiding the tripping mech-ism and the forceful punch in the head that ac-mpanies tripping. Individually, nectar gath-ing bees trip fewer flowers than pollen gatherers, e number depending on the condition of the ant. However, nectar gatherers usually out-mber pollen gathers in the field and because of eir greater numbers may contribute nearly as uch tripping. Placing colonies in or adjacent to e alfalfa field may result in more tripping. Pos-bly the younger bees range less widely from the ve, or they trip more blossoms while "learning" obtain nectar without tripping.

Of course, many factors enter into the setting of good seed crop. Providing a heavy concentra-on of bees will not in itself insure a seed set. roper attention must be given to the agronomic ctors and the harmful insects must be controlled. isregarding any of the essential factors may re-lt in a seed crop failure.

A problem which calls for unusual skill and genuity on the part of entomologists is how to ntrol the harmful insects on alfalfa without so destroying the pollinators. The most harm-l insects to seed production are the lygus bugs hich feed on the developing buds and flowers, preventing adequate flowering and doing other damage. It is a tribute to entomological skill that methods have been worked out whereby these insects can be controlled with a minimum of destruction to the pollinators.

Arizona has some features which are unique in beekeeping. The intense summer sun makes it necessary to provide shade over apiaries. These shades are called ramadas and may be seen about the valleys. It is surprisingly cool in the shade of the ramada. This idea was probably borrowed from the Indians. In some locations, supplying water for the bees becomes a problem. It has been found that a colony needs about a pint of water a day to maintain the bees in good condition. Where water is not available within a reasonable distance from the apiary, the beekeeper must haul it.

Back in 1872 it would have required unusual faculties on the part of General Allen to have visioned the value of the industry he was initiating. Even today it is difficult to grasp the full import of maintaining a healthy bee industry. Fortunate it is for the State that, during the three quarters of a century which have elapsed since bees were first brought to Arizona, the expansion of bee culture has kept pace with the rapid development of agriculture. THE END.

(Reprinted from the September 1950 issue of "Arizona Highways," through the courtesy of the editor, Raymond Carlson, and the permission of the author, Frank Todd.)

Rudy A. Simonson Receives Gold Medal

Rudy A. Simonson, Reclamation engineer aide at Elverta, Calif., was presented with the Interior Gold Medal for Distinguished Service by Assistant Secretary of the Interior William E. Warne on April 27, 1951, for "heroism, involving personal risk over and beyond the call of duty."

For 4 days, much of the time during the blizzard of March 1950, Mr. Simonson insisted upon trying to save the life of his chief, Ardis G. Ribbeck, Chief of the General Engineering Section. On Thursday evening, March 9, 1950, Ribbeck and Simonson were on a reconnaissance trip near Klamath Falls, Oreg. Shortly after noon the next day, they ran into a severe snowstorm, had to abandon their car because of impassable roads, and began to search for food and adequate shelter. Mr. Ribbeck became progressively weaker from

(Please turn to page 232)

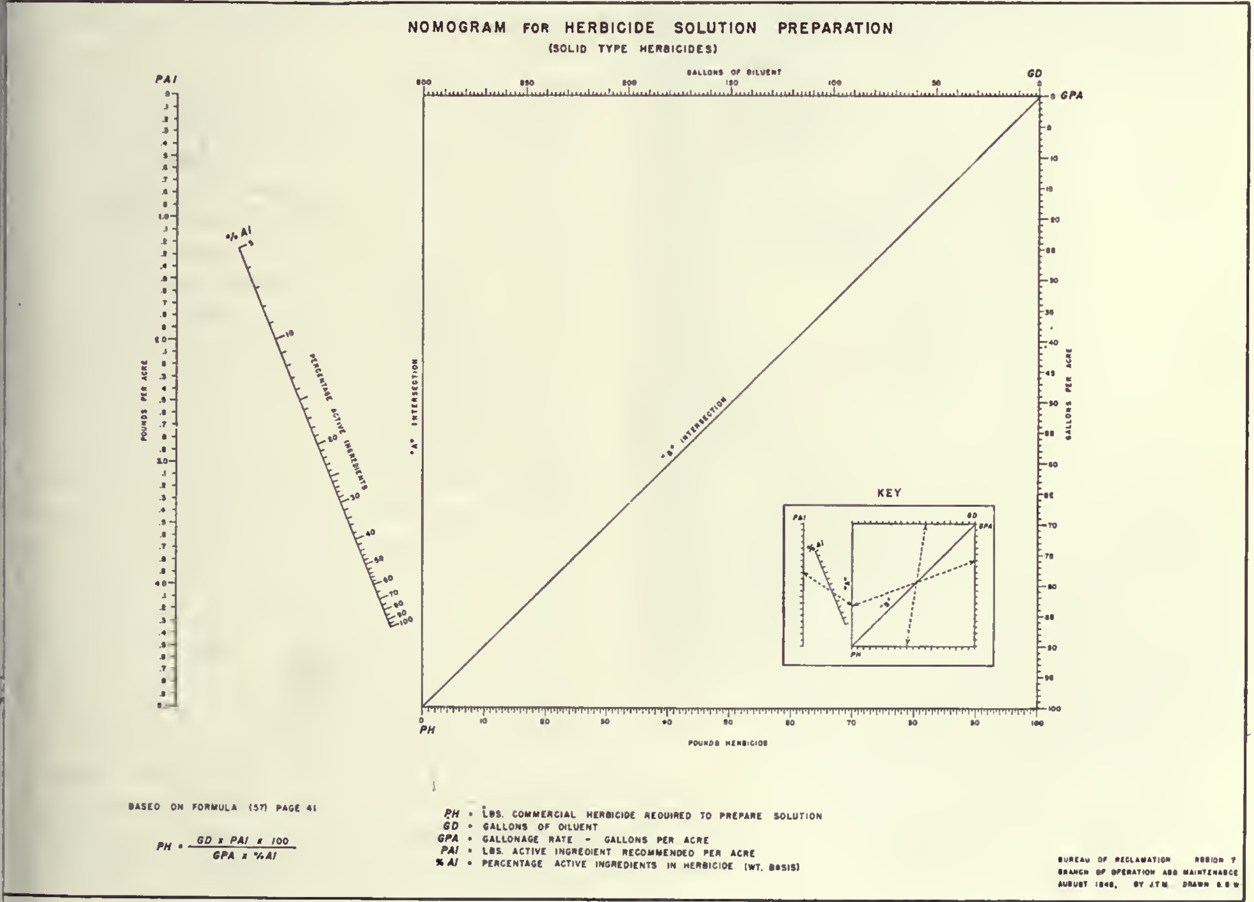
SHORT CUTS TO WEED KILLING CALCULATIONS

PART 5—Preparing Weed Killing Solutions With Powder

by JOHN T. MALETIC, Weed Specialist and Soil Scientist
Region 7 Headquarters, Denver, Colo.

MANY OF THE WEED KILLING CHEMICALS NOW VAILABLE come in powder form. Some examples re 2,4-D acid, ammonium salt of 2,4-D, anhydrous dium salt of 2,4-D, monohydrate sodium salt of 4-D, a new amine salt of 2,4-D, sodium penta-lorophenate, polyborchlorate, sodium trichlo-acetate (TCA), potassium cyanate (KOCN), nmonium sulfamate (ammate), and phenyl ercuric acetate (PMAS). When using powder pe chemicals, such as these, a solution has to prepared by mixing the chemical with water or me other diluting agent. Often, as in the case of 4-D products, the recommendations specify that certain amount of the active ingredients must be pplied per acre to get best results. The question en comes up, "How much chemical should be ixed with water to get the desired application te?" The answer has two parts: (1) calibrate e rig (see last month's article in this series for the rocedure) and (2) use data appearing on the label f the product and the calibration information to gure the amount of chemical to use. If you re using a powder type chemical, you can get e answer quickly from the nomogram below.

Here is what you have to know: (1) The amount of active ingredients in the chemical weed killer, (2) the chemical application rate in terms of pounds of active ingredients to be applied per acre, (3) the amount of water to be used in gallons, and (4) the gallonage rate in terms of gallons per acre (determined during calibration). These values all appear on the scales of the nomogram and all you have to do is to connect the values with a transparent straight edge as shown in the key to get the answer to your problem. If you have a small spraying job to do (when only 5–10 lbs. of chemical are needed), we recommend you use the formula to get the answer because the width of lines on the nomogram will throw your answer off enough to be of importance. All you have to do to use the formula is to multiply the gallons of water to be used by the pounds active ingredients to be applied per acre—call this Product 1. Then, multiply the gallonage rate (gallons per acre) by the percentage active ingredients in the chemical—call this Product 2. Next, divide Product 2 into Product 1 and multiply your result by 100.



Rudy A. Simonson Receives Gold Medal

(Continued from page 229)

exhaustion and exposure, but insisted that Simonson leave and attempt to save his own life. Simonson refused and did everything possible to protect Mr. Ribbeck. After Ribbeck lost consciousness, Simonson prepared a makeshift shelter but was unable to build a fire because of lack of dry materials. He watched over Ribbeck through Friday night, and in the morning located an abandoned cabin where he lit a fire. Returning to Ribbeck, Simonson managed to get him to the cabin where he tried to revive him. It was too late, and Simonson remained with the dead man's body from Saturday until the following Monday morning at 4:30 a. m., when a rescue party arrived. •

District Counsel Stoutemyer Dies

Bernard E. Stoutemyer, retired district counsel of the Bureau of Reclamation died at Portland, Oreg., on May 22, 1951, at the age of 72, after a long illness. Mr. Stoutemyer's passing will be noted with regret by all the old timers of the Bureau who will recall him as one of the most outstanding lawyers in the field of reclamation law, having served 37 years of continuous service in the legal ranks of the Bureau.

Mr. Stoutemyer, born in New Orleans, La., was a graduate of the Law School of the University of Michigan, and was appointed assistant examiner of the United States Reclamation Service at Boise, Idaho, in December 1906. He was a district counsel between 1919 and 1944, with headquarters at Boise, Idaho, until 1926, and at Portland, Oreg., from 1927 to 1944.

He was an outstanding trial and water rights attorney and a distinguished pioneer in the development of the principle of multiple-purpose projects of the Bureau in the Pacific Northwest. Readers of the Reclamation Era may remember his unusual series, entitled, "The Legal Status of Water Rights in the Pacific Northwest" which appeared in 1935 and 1936, setting forth the nature and complexities of the law of water rights affecting reclamation projects in Oregon, Idaho, and the State of Washington.

Edward W. Fisher, chief counsel of the Bureau, on learning of his death, said, "Mr. Stoutemyer's long association in the Bureau has contributed richly not only to those of us whose lives he touched personally throughout the years but also in a much larger sense, to the innumerable undertakings which are now reaching full stature of accomplishment in the development of the Northwest. The understanding and assistance he so freely gave to these ends with unselfish devotion will long provide a firm foundation and continuing guide to reclamation development throughout the West." •

Canal Designer Receives Award

When it comes to design, Harry R. McBirney is to the thousands of miles of canals what Jack Savage is to the many dams on the 60-plus Bureau of Reclamation projects. Because of his efforts over 40 years to make the Bureau of Reclamation irrigation canals, the best, biggest, most economical, and yet serve the greatest number of people Harry McBirney was recently awarded the Interior gold medal for distinguished service.

He retired last July 31 after holding the position of chief of the canals division in the Office of the Chief Engineer in Denver since 1927. During the years when great Reclamation dams were being designed to prevent the flow of water to the sea, McBirney was busy designing canals, tunnels, and diversion structures which would get the water to the thirsty lands and thus accomplish the end means for which Reclamation is intended—irrigation. Stored water behind dams without charted courses throughout the countryside to its final destination, the land, would hardly benefit the people except through power. Through McBirney's ingenuity the water served twofold purposes in many instances—first, to develop hydroelectric power, and second, after pouring through the turbines, it served as an irrigation source for downstream parched lands.

His outstanding works include the river-size Friant Kern Canal on the Central Valley project and the All-American Canal which carries the Colorado River into the rich Imperial Valley of California. He also supervised the design of the gigantic canal distribution systems on the Columbia Basin project, in Arizona-Nevada, and Colorado Big Thompson project in Colorado.

He began his Government career with the Interior Department's General Land Office in 1907–08, joining the Reclamation Service, later the Bureau of Reclamation, shortly thereafter. He is a native of Conrad, Iowa. •

America Needs All of Us

(Continued from page 213)

nse to every man who has the responsibility of iffing a job, whether it be construction, shop ork, farming, or a business office.

You talk to Ed Sizer, electrician for G-S-M, no had his right leg blown off just below the ee when he and 26 other members of a First arines' observation post were caught in a deadly il of machine gun and rocket fire behind the panese lines in Okinawa. Today, Ed skis, ates, swims, and packs a bowling average as gh as 169. The determination and the will to cceed that have enabled Ed to overcome his ndicap and engage successfully in these sports e the qualities that make him a valued employee the G-S-M organization. Ed's artificial leg esn't bother him much. In fact, he seems to be uch more sensitive about his receding hairline—ways bowls with a cap on.

At the contractor's heavy-duty machine shop, u run across Art Stratton who has to be careful at he doesn't weld the hook that serves as his ght hand to the tractor frame he is working on. rt lost his arm and his right leg under a rail-ad car many years ago, but the tragic accident dn't keep him from doing his part as a welder the Lake Washington shipyard during the Sec-d World War. He's been on the Hungry Horse b for 3 years, and his shop foreman, Leo Leifes-r, says welders don't come any better than Art.

It is significant that a majority of the physically ndicapped men on the Hungry Horse job are nployed as cableway operators or cableway sig-lmen. This is startling, to say the least, when u realize the tremendous responsibility that sts on the shoulders of the men who fill these bs. They are key men in a high-speed opera-on that keeps concrete moving from the mixing ant to the dam at an average rate of 7,600 cubic rds, or 30,400,000 pounds every 24 hours.

You make the long climb to the operators' tower ichored high on the canyon wall and step into ie of the glass-enclosed booths. Through the indow in front of the operator you see the 139-ot high concrete mixing plant and Montana's

CAME BACK—Alton C. (Al) Black (top) operates cableway after 65-ot fall. John McKee carries on as signalman despite lost right arm. l Crouch once a polio victim, now a winner (at right), chats with Martin rtuem. Alvin E. Hendrickson who spent 13 years in hospital now calls nals for Hungry Horse. ***All photos by James Clausen, Region 1.***

GIRL'S BEST FRIEND with Jean Cameron (top). Engineer Stuart M. Blydenburgh operating slide rule with ease. Settler William S. Lovercheck (at right), lower photo, doesn't let his injuries interfere with developing his Columbia Basin farm at Pasco, Wash.

shortest and busiest railroad on which Diesel powered "dinkies" shuttle back and forth carrying concrete from the mixing plant to the cableway buckets. The operator leans forward tensely and his hand flicks over the controls quickly and surely in response to a series of flashing lights and staccato buzzer signals. Then, through a speaker, comes the low voice of the operator's signalman, "Give us a little headtower, Ralph—easy, hold it—now bring her down a bit. This is a tight spot—not much clearance—O. K., dump her and highball it." Following the operator's eyes, you see the big 8-cubic-yard concrete bucket leap skyward as it drops its 16-ton load of concrete in one of the massive concrete blocks rising in the river canyon.

As he flips the controls that swing the bucket back across the canyon to the loading dock, cableway operator Ralph Olson turns and greets you.

Then you make a surprising discovery. Ralph is literally bolted to his job. A special steel joint designed by Ralph and machined in the General Shea-Morrison machine shop, connects his artificial left arm with the cableway speed control. The special joint, which has a ball-bearing swivel to give it the smooth flexibility of a man's normal wrist, screws on to the artificial arm and bolts firmly to the speed control handle.

You learn that Ralph lost his left arm above the elbow 17 years ago when his car was sideswiped by a truck. He broke in as a cableway operator at Shasta Dam in 1941 and has been operating cableways steadily since that time. You learn from other men on the job that he is one of the best.

You drop to the operator's tower on the graveyard shift and talk to Al Black who started operating a cableway at Hungry Horse in April 1951. Al worked as a signalman at Hungry Horse last year—his first job since his recovery from almost fatal injuries received in a 65-foot fall from a whirly crane at Davis Dam in 1947. Al's permanent injuries include a crippled left arm from which the elbow joint has been removed, and a crippled left leg. But his bad left arm handles the cableway controls as quickly and surely as his good right arm.

Physically handicapped signalmen working on the Hungry Horse job include John McKee who lost his right arm above the elbow in a logging accident. He also wears a brace on his paralyzed right leg.

Then there's Al Hendrickson who spent 13 of his first 15 years in hospitals fighting TB of the spine and leg. He started working at the project as a guard in 1948, later tried his hand at clearing work in the 34-mile long reservoir area, and then returned to the dam where he was a checker at the mixing plant for a time before starting his present work as signalman.

Up at the concrete mixing plant, Cal Crouch, [illegible]k foreman, gets around with amazing agil-[illegible], in spite of his polio-crippled left leg. Cal [illegible]rks the graveyard shift, supervising clean-up [illegible] the busiest and most dangerous spot on the [illegible]ngry Horse job.

Looking back on your hurried trip over the [illegible]ject and your talks with these men who are [illegible]ng their jobs in spite of lost or maimed arms [illegible]l legs, you wonder a little that you haven't [illegible]lized before how many there are on the job. [illegible]d then the truth dawns on you. They are do-[illegible] their jobs so quietly and so efficiently that [illegible] just don't realize that they have physical [illegible]ndicaps.

COLUMBIA BASIN PROJECT

Of the approximately 2,000 employees of the [illegible]umbia Basin district in the State of Washing-[illegible], a quick count reveals approximately 175 are [illegible]point preference veterans.

Typical of these is Ellis Shorthill, photog-[illegible]pher, who was in the Pacific Theatre when he [illegible]eived a head injury from an exploding gre-[illegible]le, which paralyzed him completely. After [illegible]ut 3 months in an American hospital during [illegible]ich time he regained his ability to walk, he was [illegible]tured by the Japanese and was a prisoner of [illegible]r for 2½ years. He continues to have difficulty [illegible]h the left side of his body but the handicap [illegible]s not prevent him from doing good photo-[illegible]phic work—see page 217 of this issue.

William S. Lovercheck, a World War II para-[illegible]oper living on Irrigation Block 1 of the Co-[illegible]bia Basin project, has overcome his serious [illegible]rtime injuries so well that very few people can [illegible] the extent to which his injuries interfere, if [illegible]all, with his farming.

JEAN CAMERON

Blind since birth, Miss Jean Cameron, an em-[illegible]yee in the Commissioner's Staff Offices in Den-[illegible], has proved that a physical handicap is not of [illegible]essity a deterrent to the leading of a full and [illegible]py life.

Jean is employed as a dictating machine trans-[illegible]ber. She came to Reclamation in 1944 as a [illegible]nographer transferring from Lowry Air Force [illegible]se in Denver where she had been employed as [illegible]lerk-typist for a year and a half.

Jean and her seeing-eye dog, Mabel, have be-[illegible]ne an essential part of the environment in the [illegible]reau of Reclamation offices at the Denver Federal Center. Jean arrives at her job every morning in her own automobile. An extremely satisfactory arrangement with fellow workers who live in her neighborhood whereby they drive and Jean rides, permits her the comfort of personal transportation to and from her office.

Born in Lehi, Utah, Jean attended the Colorado School for the Deaf and Blind in Colorado Springs, Colo. In 1933 she enrolled at Colorado Woman's College in Denver, concentrating on psychology, history, social sciences, and Spanish. She completed the prescribed 2-year course, and was awarded an associate in arts degree in 1935.

She is an accomplished vocalist, plays the piano and organ, and has had magazine articles published. She is keenly interested in music, stage plays, and movies. Her "handicap" in no way hinders Jean's full participation in practically all types of social activity.

In her present position as dictating machine transcriber, one of Jean's principal tasks is the transcription of the proceedings of meetings in which several speakers participate. Following the initial introductions, Jean depends solely upon the speaker's voice for identification. Final preparation of drafts of the proceedings is also her responsibility. An award for superior accomplishment in 1948 and consistently high yearly efficiency ratings attest to Jean's capability.

It seems incongruous to speak of Jean Cameron as "handicapped." Her ability and her independence exceed that of many who have complete possession of their physical faculties. Those who know her well are quick to point out her ability to be the "life" of any gathering in which she may participate. Her cheerfulness, ability, and lively interest in all aspects of life provide a model for any who know Jean Cameron.

STUART M. BLYDENBURGH

"Stu" Blydenburgh was employed by the Bureau of Reclamation in 1949, following his graduation from Case Institute of Technology in Cleveland, Ohio. He was awarded a bachelor of science degree in Civil Engineering from this institution in June 1949. Prior to his entry into the Army, he attended Ohio Wesleyan University for 2 years. Summer employment between semesters as an engineering aide with the Buffalo District Office of the United States Corps of Engineers preceded his permanent employment by the Bureau of Reclamation.

Shrapnel wounds while in action in France in 1944 resulted in the loss of Stu's left arm. This loss has affected neither his desire nor his ability to get ahead.

Mr. Blydenburgh is now assigned to the Special Assignments Section of the Dams Branch in the Division of Design and Construction in Denver. He recently completed a series of the rotation assignments in which many of the Bureau's young engineers participate. Stu's ability to do an outstanding job has been recognized by a recent raise in grade and salary.

As a civil engineer in the Structural Behavior Unit of the Special Assignments Section, Stu is responsible for preparing detailed drawings from rough sketches, notes, and oral instructions. He also assists in the compilation and analysis of data received from field offices in the form of reports and instrument readings.

Stu's missing left arm has not affected his ability to perform high-caliber work. Equipped with a prosthetic limb, he has become proficient in its use. It permits him, for example, to hold the steering wheel of his auto or to pick up objects if the occasion demands.

Stu's supervisors have rated as "outstanding" his dependability and his willingness to cooperate in the accomplishment of work to be done.

HARRISON J. HURLBURT

A little more than a year ago, on September 14, 1951, to be exact, a strapping air corps veteran walked into the Bureau of Reclamation's Yakima project office in the State of Washington. He was a lucky winner of one of the 11 Roza homesteads. The ex-lieutenant, who had lost his foot in the service of his country, had come to claim his farm.

This year, farmer Hurlburt has an artificial limb and is not dependent any more on the use of crutches. In the meantime, he has raised over 50 acres of crops—25 acres of peas, planted with alfalfa that will be raised for seed, 17 acres of red Mexican beans, and 12 acres of sweet corn—doing most all the work by himself, with the aid of his faithful tractor. Except initial planting and harvesting, Mr. Hurlburt estimates he has not spent over $50 for outside labor.

He even built his own house, obtaining it from the White Bluffs area (Hanford Atomic Energy works vicinity), had it moved in three sections, built his own foundation, and reassembled it with the aid of one other man. He has electric power and hopes to obtain domestic water through a proposed cooperative well agreement of neighboring farmers.

Hurlburt has invested all of his capital in the farm and plans to stay with it—says it is too short a time yet to decide whether or not he will be successful, but doctors have certified that he has the makings of a successful farmer and is equal to most others.

On page 125 of the July 1951 issue appears another example of a wounded World War II veteran who made good on his "Home in the West." THE END

Buckeye County Water Contract OK'D

William E. Warne, Acting Secretary of the Interior, on July 3, 1951, approved the form of contract under which the Bureau of Reclamation's Central Valley project will supply municipal and industrial water to Buckeye County Water District in California.

The contract has been sent to the district which will hold an election for the purpose of voting to sign the contract, in the near future.

The Buckeye County District is located near Redding, California, in an area of the larger lumber and mining centers of Northern California. Availability of Central Valley's hydroelectric power and water is expected to result in an expanding population and a growing industrial section. Municipal and industrial water now obtained from wells is insufficient to meet this anticipated expansion.

The contract provides for replacing an outmoded pipeline now carrying water from Shasta Dam to a Government Camp at Toyon and other customers. The old pipeline is insufficient in size and capacity to serve the present expanded area. This new line will serve the Buckeye District as well. Under the contract the district is scheduled to pay $20 per acre foot for municipal and industrial water, and agrees to accept and pay in advance annually for 45 acre-feet for the first 5 years of operation. •

N. R. A. Convention Scheduled

The twentieth annual convention of the National Reclamation Association will be held in Amarillo, Tex., October 17, 18, and 19. Headquarters for the convention will be the Herring Hotel. •

‌eclamation Boosts Population

)NE OF THE FAVORITE SAYINGS of Senator Francis wlands of Nevada was, "Every city in America ws to the West," and most everyone is familiar h the famous Horace Greeley quotation in-ıcting young men on the most desirable point he compass to follow.

Census Bureau population figures indicate the idity of Senator Newlands' observation, and the ılts of Mr. Greeley's suggestion. The young n (and women, too, evidently) went to the West, il the preliminary 1950 figures show that dur- the last 10 years the 17 Western States had a ulation boom of 24.9 percent compared to the in population of the entire United States at percent.

Iany factors contribute to population trends, it seems more than a coincidence that the States h the greatest amount of reclamation activity those in which the greatest increases occurred ring the past decade.

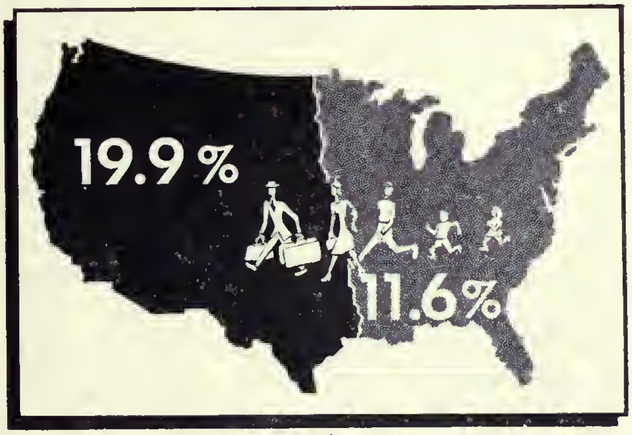
The accompanying map graphically indicates difference between the growth of the East and the West, and here is a break-down of the preliminary Census Bureau figures for the 17 Reclamation States:

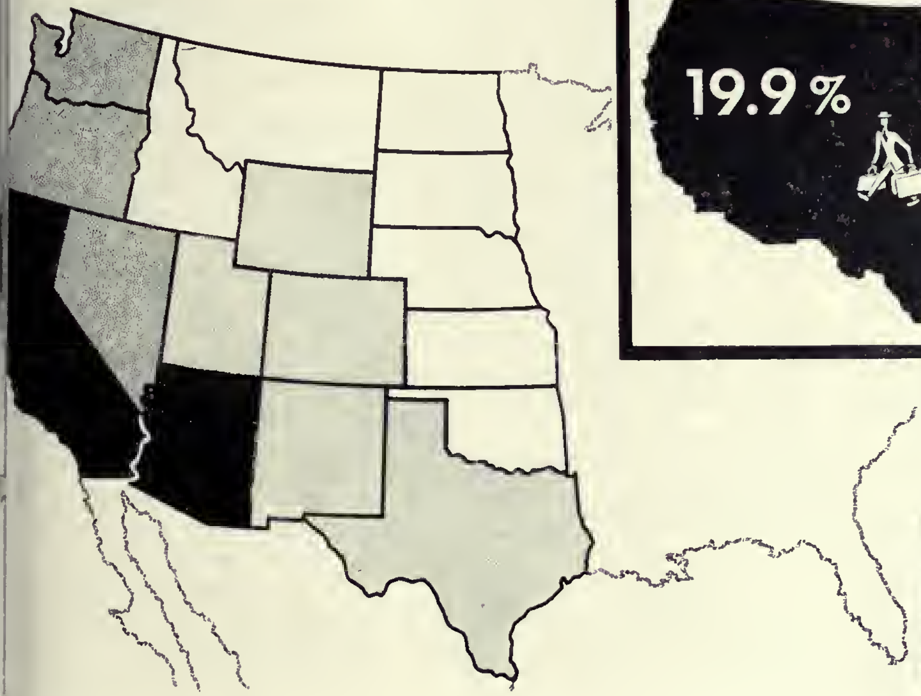
CENSUS BUREAU

Population Figures—17 Western States

Rank in Nation	State	Population		Change 1940–50	Percent of change	
		1940	1950 [1]		1930–40	1940–50
38	Arizona	499, 261	745, 259	245, 998	14.6	49.3
2	California	6, 907, 387	10, 490, 070	3, 582, 683	21.7	51.9
34	Colorado	1, 123, 296	1, 318, 048	194, 752	8.4	17.3
44	Idaho	524, 873	585, 092	60, 219	17.9	11.5
31	Kansas	1, 801, 028	1, 894, 390	93, 362	−4.3	5.2
43	Montana	559, 456	587, 337	27, 881	4.1	5.0
33	Nebraska	1, 315, 834	1, 318, 079	2, 245	−4.5	.2
49	Nevada	110, 247	158, 283	48, 036	21.1	43.6
40	New Mexico	531, 818	677, 152	145, 334	25.6	27.3
42	North Dakota	641, 935	617, 965	−23, 970	−5.7	−3.7
25	Oklahoma	2, 336, 434	2, 223, 650	−112, 784	−2.5	−4.8
32	Oregon	1, 089, 684	1, 512, 100	422, 416	14.2	38.8
41	South Dakota	642, 961	650, 029	7, 068	−7.2	1.1
6	Texas	6, 414, 824	7, 677, 832	1, 263, 008	10.1	19.7
39	Utah	550, 310	686, 797	136, 487	8.4	24.8
23	Washington	1, 736, 191	2, 363, 289	627, 098	11.1	36.1
48	Wyoming	250, 742	288, 800	38, 058	11.2	15.2
	Total	27, 036, 281	33, 794, 172	6, 757, 891	+9.2	+24.9

[1] 1950 Census of Population Release Nov. 5, 1950, Bureau of Census U. S. Dept. of Commerce.





WATER REPORT

The extreme, long-continued drought in the lower Colorado River Basin, including the Verde and Salt River subbasins, was broken by storms August 28–30. From 3 to 5 inches of rain were measured at a number of gaging stations in central and western Arizona during those 3 days. Unfortunately, the drought still continued, with but little relief, in New Mexico and Texas. Irrigation water supplies were plentiful over most of the remainder of the 17 Western States, as of the first of September.

By regions (see map on back cover for locations) the irrigation water supply situation is as follows:

REGION 1—The outlook remained generally excellent. Two pump units at Grand Coulee Dam were operated continuously throughout the month of August, pumping a total of 172,000 acre-feet of water into the Grand Coulee equalizing reservoir. Initial diversion from the equalizing reservoir began on August 10, with a total of 59,580 acre-feet being diverted into Long Lake and the Columbia Basin project distribution system during the remainder of the month.

REGION 2—Inflow into both Shasta and Millerton Lakes was a little above normal for the month of August. The first pumps were placed in operation at the Tracy pumping plant, and for the first time, Sacramento River water was transferred to the San Joaquin River Basin, through the Delta-Mendota Canal. Irrigation water supplies will be sufficient over all of the Central Valley project except for the Friant-Kern and Madera Canal service areas below Millerton Lake where the supply remains subnormal.

REGION 3—Storage in Lake Mead remained below normal although storms during the latter part of August on the upper watershed indicated increased storage in September. Combined storage in the Salt River project reservoirs was about 260,000 acre-feet on August 31, an increase of 150,000 acre-feet over the storage in the same reservoirs on July 31. This will be extremely helpful for the balance of the current year, but is still well below average.

REGION 4—There was sufficient rainfall in previously dry areas to improve the over-all water picture materially. By the first of September all projects were assured sufficient water for maturing normal crops.

REGION 5—Water supplies were plentiful on the W. C. Austin and Tucumcari projects, but there was little or no relief from drought in southern New Mexico and Texas. Alamogordo Reservoir, on the Pecos River, which was empty on August 1, received sufficient inflow during the month to provide storage of 12,500 acre-feet on August 31. McMillan and Avalon Reservoirs were practically empty, however, on that date. Inflow of 10,000 acre-feet was recorded at Elephant Butte Reservoir, but total storage in Elephant Butte and Caballo Reservoirs at the end of August was down to a total of 45,000 acre-feet, setting another new record low.

REGIONS 6 AND 7—Irrigation prospects continued from good to excellent on all projects except the Belle Fourche in South Dakota. Even there, however, the water supply will be sufficient for production of normal crops, but with little holdover storage in prospect in the Belle Fourche Reservoir. ●

CROPS

Central Valley and Coachella Crops Hit Peak

On the Central Valley project in California, the gross value of crops grown during 1950 was $103,014,000. This marked the highest return on any one Reclamation project for the year. Among the high priced crops grown were cotton, fruit, and grapes, with cotton showing the way.

On the Coachella Division of the All American Canal system in California an average of $433 per-acre value was chalked up during the year to lead all other Reclamation projects on the per-acre basis return. The high per-acre value received on this project was due principally to the large acreages of fruit and truck crops, mainly string beans, sweet corn, and dates. ●

LETTERS

"Unsung Benefits" Being Sung

1338 CAPITOL AVENUE,
DES MOINES, IOWA,
June 23, 1951.

DEAR MISS SADLER: I seem to recall that I wrote you a letter, thanking you for allowing me to use the essay by Lee Watenpaugh in my manuscript on water. But since I cannot locate the carbon I may have only intended to, and never did. Anyway, it's better to send two, and be sure about it than to fail to write. And so I do thank you for so kindly allowing me to use this excellent essay of Lee's: I am sure it will help my book to have appeal for children.

Yours sincerely,

IVAH GREEN.

(Lee Watenpaugh's manuscript, "Irrigation's Unsung Benefits" which appeared in the June 1951 issue has been picked up by many publications, no[t] least of which was the Congressi[onal] Record, issue of June 11, 1951, in w[hich] it was introduced by Congressman J[.] R. Murdock of Arizona.—Ed)

Love That Lubbock!

LUBBOCK, TEX.,
May 17, 19[5]

MR. E. D. EATON, *Director,*
Branch of Operation and Maintenance,
Bureau of Reclamation,
Washington, D. C.

DEAR MR. EATON: Thank you [v]ery much for the three copies of the M[ay] 1951 issue of RECLAMATION ERA w[hich] carried a picture of Lubbock. May [I] also take this opportunity to praise Garford Wilkinson and the staff [of] RECLAMATION ERA for the excel[lent] treatment of the Canadian R[iver] project feature.

If we can ever be of further servi[ce to] you, please do not hesitate to le[t us] know.

Again, thank you for your letter [and] the magazines.

Sincerely yours,

OTICE A. GREEN,
LUBBOCK CHAMBER OF COMMERC[E]

RELEASES

Hollywood Says "Water in th[e] West" is "Finest Film"

Among the congratulatory letters [re]ceived from members of the televi[sion] and screen industry regarding [the] Reclamation film entitled, "Water [in] the West" was one from Robert Gug[gen]heim, manager of Film Operations [of] Hollywood, Calif., Television Stat[ion] KNBH, in which he said, ". . . thi[s is] the finest documentary—even gove[rn]mental documentary—film it has [been] my pleaseure to see. We believe [the] minimum audience for your show (set for June 23d) will be appr[oxi]mately three hundred thousand view[ers] with the potential audience somewh[at] far above that estimate.

". . . Its presentation, as well, w[ith] the complete music cue sheet, et cete[ra] has been one of the best we have b[een] offered from any source." ●

w Project Folders Available

y project folders for the Boise and ibia Basin projects, and the Boy- nd Canyon Ferry Units of the uri River Basin projects are now ble to the public. These are rated and contain a number of sting statistics in addition to a ary narrative on each of the ts.

re is no charge for the folders. s may be obtained by writing to y Services Division (Attention: Bureau of Reclamation, Denver al Center, Denver, Colo.

ddition to the above, the Bureau published an illustrated 22-page t entitled "Working Water" which bes the Central Valley Project lifornia. Copies of this booklet be purchased for 25 cents from uperintendent of Documents, Gov- nt Printing Office, Washington C. ●

mation Manual Aids Solution of World Water Problems

Bureau of Reclamation's Man- 0 volumes of technical, engineer- and administrative experience ulated during the past half cen- is helping nearly 50 foreign gov- ents and private engineering firms lve water conservation problems er the world.

sons learned the hard way by the u which has built the largest dams ower plants in the world are also g as text books for engineering nts in more than 20 American uni- ies and colleges. At the same 26 U. S. Government and 27 State municipal agencies are benefiting the "housekeeping" or administra- and technical information in the u's manual. This information is available to those seeking it at nial cost. ●

A Releases Kentucky Project Report

e Tennessee Valley Authority an- ces the publication of Technical rt No. 13 on the planning, design, ruction, and initial operation of Kentucky project on the Tennessee r. Besides the importance of the ucky project in the over-all system ations and as a point of public interest, its layout, design, and construction involved problems and methods of particular interest to engineers and constructors engaged in similar river-control work. The report contains 877 pages, including 307 illustrations and exhibits.

The report covers in detail preliminary investigations for the project, including geology and river flow; dam and powerhouse design; construction methods, including construction plant, river diversion, employee housing, and access facilities; relocations and adjustments in the reservoir area; initial operations; and a complete summary of the project costs. The appendixes include a complete statistical summary of physical features of the project; reports of the engineering and geologic consultants; summaries of hydraulic studies; a summary of design of Kentucky Dam against earthquake; and lists of classified construction equipment and major purchases of material and equipment. Bibliographies on each phase of the project are also included.

The Kentucky Project may be procured from the Tennessee Valley Authority, Treasurer's Office, Knoxville, Tennessee, for $3.25. Other published reports in this series include: The Norris Project, published in 1939; The Wheeler Project, 1940; The Pickwick Landing Project, 1941; The Guntersville Project, 1941; The Chickamauga Project, 1942; The Cherokee Project, 1946; The Hiwassee Valley Projects, Volume 1, 1946; The Hiwassee Valley Projects, Volume 2, 1947; The Douglas Project, 1948; The Watts Bar Project, 1948; The Watts Bar Steam Plant, 1948; The Fort Loudoun Project, 1949; and The Fontana Project, 1949. Except for the Norris, Wheeler, and Pickwick project reports, which are out of print, these reports in limited quantity are currently available from the Tennessee Valley Authority, Treasurer's Office, Knoxville, Tennessee. ●

New Maps Available

Two new project maps have been released by the Bureau of Reclamation, as follows: Cachuma Project, Calif., and Sun River Project, Mont. These maps are all in color. The Cachuma map is available in two standard sizes, 10½ by 17 inches and 21 by 34 inches. The Sun River map is available in the 10½ by 17 inch size. Those who wish to obtain these maps should send their requests to their nearest regional director (see directory on inside back cover of this issue), and specify name and size of maps desired. Single copies are free to those who have need of them in connection with their work or studies.

POSTSCRIPTS

Adjustable "Squelch" for Radiophones

A new version of a portable FM radiophone has recently been introduced with an adjustable squelch which cuts down on tube and circuit noises up to 25 to 50 decibals. The adjustable squelch, which is mounted on the power supply chassis, is also claimed to eliminate any possible audio distortion resulting from using the portables in fringe areas. Further information may be obtained from Motorola's Technical Information Center, Communications and Electronics Division, 4545 West Augusta Boulevard, Chicago 51, Ill.

Conservationist's Prayer at Eventide

Lord of the sunset, the forests, and the water, grant me the peace to accept those things that are immutable, grant me the courage to change those things that may be changed, and grant me the wisdom to know the difference.

(From the inside back cover of the August 1951 issue of the *Missouri Conservationist* published monthly by the Missouri Conservation Commission.)

The average size of American farms has not increased significantly in the last 80 years; the typical farm remains a family-sized production unit, says a Twentieth Century Fund report.

John MacGilchrist, of the Division of Design and Construction, Denver, Colo., whose signature appeared on the upper left hand drawing on page 198 of last month's issue, also produced the other drawings on pages 198 and 199. The Washington, D. C. Graphics section prepared the map.

T. R. Broderick, not Charles A. Knell, was the photographer for the photo on page 193, September 1951 issue. Charlie took the picture on page 192.

NOTES FOR CONTRACTORS

Contracts Awarded During August 1951

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address
DS-3366	Central Valley, Calif.	Aug. 6	3 lots of steel manifolds for pumping plants S4, S5, S6, S7, S8, S9, S12, S13, and S14 on laterals 124.5E, 125.7E, and 130.4E, unit 3, Southern San Joaquin municipal utility district, Friant-Kern canal distribution system.	The Lang Co., Inc., Salt Lake City, Utah.
DS-3425	Columbia Basin, Wash.	Aug. 3	3 vertical-shaft turbine-type pumping units for Lower Scooteney pumping plant (PE-27) and Upper Scooteney pumping plant (PE-27A), Potholes East Canal laterals, area P-2, schedule 1.	Pump & Equipment Co., Seattle, Wash.
DS-3436	Central Valley, Calif.	Aug. 23	1 motor-control switchgear assembly and 1 112.5-kv-a transformer for Tranquer pumping plant.	Westinghouse Electric Corp., Denver, Colo.
DS-3450	Boulder Canyon, Ariz.-Nev.	Aug. 14	3 current and 3 potential transformers for Metropolitan water district—Southern California Edison Co. tie line, Hoover switchyards.	General Electric Co., Denver, Colo.
DS-3452	Columbia Basin, Wash.	Aug. 20	1 power transformer with 3 lightning arresters for Babcock pumping plant switchyard, schedule 1.	General Electric Co., Denver, Colo.
DC-3455	Klamath, Oreg.	Aug. 1	Construction of earthwork and structures for N canal area, second extension on Tule Lake sump, and outlet structures for pumping plant No. 6.	George E. Stacy, Tule Lake, Calif.
DS-3462	Central Valley, Calif.	Aug. 29	6 motor-driven, vertical-shaft pumping units for Columbia canal pumping plant No. 1 and Mowry canal pumping plant, schedule 1.	Food Machinery and Chemical Corp., Los Angeles, Calif.
DS-3492	Columbia Basin, Wash.	Aug. 20	1 power transformer with 3 lightning arresters for Upper Saddle Gap pumping plant switchyard, schedule 1.	Maloney Electric Co., St. Louis, Mo.
DS-3444	Colorado-Big Thompson, Colo.	Aug. 17	1 motor-control switchgear assembly and one spare circuit breaker removable element for Willow Creek pumping plant.	Westinghouse Electric Corp., Denver, Colo.
DS-3466	Missouri River Basin	Aug. 3	4 carbon-dioxide fire-extinguishing systems and 35 cylinders of carbon dioxide for Boysen and Canyon Ferry power plants.	C-O-Two Fire Equipment Co., Newark, N. J.
DC-3495	Hungry Horse	Aug. 7	Furnishing and installing 1 electric elevator in control bay	Elevator Maintenance Co., Ltd., Los Angeles, Calif.
DS-3459	Columbia Basin	Aug. 10	3 vertical-shaft pumping units for Ringold pumping plant, Potholes East canal, area P-6.	Economy Pumps, Inc., Hamilton, Ohio.
DS-3472	Missouri River Basin	Aug. 5	1 main control board for Huron substation, schedule 1	Nelson Electric Mfg. Co., Tulsa, Okla.
DS-3472	do	do	3 main control boards for Mount Vernon, Sioux Falls, and Watertown substations, schedules 2, 3, and 4.	Kirkhof Electric Co., Grand Rapids, Mich.
DS-3475	Colorado-Big Thompson, Colo.	Aug. 29	2 54-inch butterfly valves for penstock intake at Flatiron power and pumping plant.	The Pelton Water Wheel Co., San Francisco, Calif.
DC-3461	Missouri River Basin	Aug. 8	Construction of 10,000-kv-a. Woonsocket substation	Main Electric, Inc., Minot, N. Dak.
DC-3454	Columbia Basin	Aug. 22	Construction of earthwork and structures for Potholes East canal, Ringold wasteway, and lateral PE-67.	Peter Kiewit Sons' Co., Seattle, Wash.
DC-3456	do	Aug. 10	Construction of earthwork and structures for Columbia River wasteway turnout, West canal.	J. A. Terteling and Sons, Inc., Boise, Idaho.
DS-3465	Cachuma	Aug. 17	1 54-inch steel outlet pipe and appurtenances for Lauro Dam	California Steel Products Co., Richmond, Calif.
DC-3496	Davis Dam, Ariz.-Nev.	Aug. 23	Construction of headquarters building for system operations and maintenance area near Phoenix.	Dunn-Donaldson Construction Co., Inc., Phoenix, Ariz.
100-C-133	Deschutes, Oreg.	Aug. 21	Clearing timber and brush along roads and in Wickiup Reservoir area.	Joe Scott, Boise, Idaho
117-C-106	Columbia Basin, Wash.	Aug. 9	Moving quonset buildings, and constructing streets and utilities at the operation and maintenance headquarters at Ekopia, Wash.	Thompson Construction Co., Kennewick, Wash.
200-C-108	Central Valley, Calif.	Aug. 14	Construction of administration building at Tracy pumping plant.	Merle C. Baldwin, Watsonville, Calif.
300-S-25	Davis Dam, Ariz.	Aug. 7	Power transformers, circuit breakers, and disconnecting switches for Tucson substation.	Pennsylvania Transformer Co., Canonsburgh, Pa.
600-C-56	Missouri River Basin, N. Dak.	Aug. 29	Warehouses, water supply wells, and storage building for Bismarck, Devils Lake, and Jamestown substations, schedules 3, 5, and 6.	Smith, Inc., Fargo, N. Dak.

Construction and Materials for Which Bids Will Be Requested by December 1951

Project	Description of work or material	Project	Description of work or material
W. C. Austin, Okla.	Construction of 5.5 miles of drains, 3.5 miles of lateral wasteway, 100 c. f. s. capacity, and 1,500 feet of asphalt membrane lining on the 400 c. f. s. capacity Altus canal near Altus, Okla.	Central Valley, Calif.	Constructing Parshall flume or similar m… device immediately above or below Cot… Creek siphon for measuring water delive… Madera Canal.
Cachuma, Calif.	Construction of Lauro chlorination and control house near Santa Barbara, Calif.	Do	Surfacing Delta-Mendota canal patrol road in vi… Tracy pumping plant near Tracy, Calif.
Do	Construction of 16 miles of 27- to 36-inch diameter concrete pipe conduit and 3 control stations, part of the Carpenteria section of the South Coast conduit near Santa Barbara, Calif.	Do	Construction of 43 miles of 12- to 42-inch d… concrete pipe lines for Exeter irrigation dis… the Friant-Kern Canal distribution system… Exeter, Calif.

Construction and Materials for Which Bids Will Be Requested by December 1951—Continued

Project	Description of work or material
do-Big Thomp- Colo.	Construction of the 1,350-foot long, 8-foot diameter Carter Lake pressure conduit about 9 miles west of Loveland, Colo.
o	Bulkheads and bulkhead gates for Flatiron power and pumping plant.
o	Hydraulically operated penstock butterfly valve controls for Flatiron power and pumping plant.
Do	Construction of 10 miles of 625- to 575-c. f. s. capacity, partially lined St. Vrain supply canal, including a 50 c. f. s. turnout feeding into the Little Thompson River, two 8.5-foot horseshoe-shape tunnels, totaling 4,350 feet in length, and a 1,300-foot long 8.5-foot circular siphon, the other siphons, chutes, and spillways, near Lyons, Colo.
do River Front k and Levee tem, Ariz.-Nev.- f.	Raising and widening the 18-mile reservation levee near Yuma, Ariz.
bia Basin, Wash.	Construction of 19 miles of 470 c. f. s. capacity, unlined Potholes East canal, including concrete chute, drop, stilling pools, and 8 concrete checks; construction of Pasco wasteway turnout and chute, and 7 county road bridges, near Ringold, Wash.
o	Construction of 4.4 miles of distribution system for part-time farm units in block 701 in lateral area W2A on West canal, near Soap Lake, Wash.
o	Construction of Lower Saddle Gap, Upper Saddle Gap, and PE17 pumping plants of 112, 90, and 15 c. f. s. capacities, including furnishing and erecting prefabricated steel buildings and constructing wasteways, 1,600 feet of lateral, and 20 miles of sublaterals in P1 and P13 lateral areas 5 miles southwest of Othello, Wash.
	Construction of Royal watermaster headquarters including 8 concrete-block, wood-frame residences and garages, brick veneer office building, shop building, storehouse, 2 Government garages, streets and utilities; and construction of temporary construction camp consisting of 35 temporary dwelling units, about 7 miles north of Corfu, Wash.
	Construction of power distribution system for gate control house and piezometer well; installation of service entrance for the headworks at O'Sullivan dam near Moses Lake, Wash.
o	Construction of 7 permanent-type, wood-frame, two- and three-bedroom houses with private garages and utilities, at operation and maintenance sites in lateral areas E-2, E-3, P-1 and P-2 on East and Potholes East canals, near Ritell and Othello, Wash.
Columbia Basin, Wash.—Con.	
Do	Drilling exploratory water supply well in part-time farm unit area near Soap Lake, Wash.
Do	Motor-control switchgear for 2,300-volt synchronous and induction motors for Babcock pumping plant.
Davis Dam, Ariz	Erection of steel structures and installation of electrical equipment for 69-kv. switchyard and transformer circuits at Davis Dam, Ariz.
Do	Main control board for 230-kv., 115-kv., and 13.8-kv. circuits for Prescott substation.
Eklutna, Alaska	Four 10,000/12,500-kva. transformers for Eklutna power plant.
Do	Two 50,000 foot-pound capacity governors for the 24,000-hp. Eklutna power plant.
Fort Peck, Mont	Main control board for 115-kv. circuits for Dawson substation.
Gila, Ariz	Construction of 28 miles of 120- to 15-c. f. s. unreinforced concrete-lined Mohawk laterals and sublaterals for Unit 1 near Roll, Ariz.
Hungry Horse, Mont	Furnishing and installing two 10,000-pound capacity, combination freight and passenger elevators.
Kendrick, Wyo	Installing armor rods and vibration dampers and changing overhead ground wire connections on 50 miles of 115-kv. Seminoe-Casper transmission line about 12 miles southwest of Casper, Wyo.
Missouri River Basin, Nebr.	Clearing 2,000 acres of Swanson reservoir area above Trenton dam.
Missouri River Basin, N. Dak.	Furnishing and erecting control buildings and towers for communication facilities in North Dakota.
Missouri River Basin, S. D.	Construction of metal or concrete-block warehouses and storage garages at Armour, Sioux Falls, Watertown, and Philip substations.
Do	Two 7,500-kva., one 15,000-kva., and one 10,000-kva., transformers for Sioux Falls, Mount Vernon, Huron, and Watertown substations.
Do	De-icing equipment for Fort Randall switchyard 230- and 115-kv. lines consisting of one 3,750-kva., one 1,500-kva., and one 500-kva. transformer, and switch assemblies.
Do	Furnishing and erecting control buildings and towers for radio communication facilities in South Dakota.
Ochoco, Oreg	Installing right abutment toe drain and spillway drain extension at Ochoco dam about 1 mile east of Prineville, Oreg.

United States Department of the Interior
Oscar L. Chapman, Secretary
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FEATURE ARTICLES

SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1.50 a year for persons residing in the United States and Canada; $2 a year for foreign subscriptions; special rate of $1 a year for members of water users' associations, and Bureau of Reclamation employees.

OUR FRONT COVER

Symbol of Thanksgiving

Gillum and his 25½-pound gobbler seem rather proud of each other in this photo. At first glance the scales appear to denote the turkey weighs less than nothing. Another glance at the cover photo and the picture of the author of "Raising Turkeys in the Columbia Basin" on the opposite page reveals how a clever photographer can wring a turkey's neck to improve the picture. Photo by Harold E. Foss, Region 1 photographer.

30 YEARS AGO IN THE ERA

Those of us who are willing to admit a recollection da
so far back as 1902, when the reclamation act was pa
will remember the oft-expressed criticism by the
makers of the provision of the act which gave the S
tary of the Interior authority to turn over the manage
of a project to the water users. There were many
scoffed at the idea of letting a lot of farmers take o
$1,000,000 plant and run it. "Perfectly absurd," they
"It can't be done."

Well, it can be and is being done today, and n
piffling million-dollar ditch system either, but a $14,0
corporation with huge power plants, inter-locking ca
pumping units, and everything. Housed in a magnif
office building, which is a credit to the enterprising ci
Phoenix, the Salt River Valley Water Users' Associ
the first to be formed under the irrigation law, is st
on the job of managing one of the large irrigation sys
in the United States and without a taint of politics.

(From page 503 of the November 1921 issue o
Reclamation Record, predecessor to the Reclama
Era.)

RECLAMATION PLACE NAMES IN THIS ISSUE

AISING TURKEYS in the COLUMBIA BASIN

OLDEN C. GILLUM

AUTHOR is a farmer on the o pumping unit, the first to receive water from the mbla Basin project in the e of Washington. Water this unit, near Pasco is ped directly out of the Co- bia River. *Photo by Harold oss, Region 1 photographer, also took the front cover re—note the turkey's neck.*

ONE OF THE BEST PLACES in the northwest to se turkeys is the Columbia Basin. The small ount of rainfall during the summer and fall kes it ideal as turkeys do better on dry ground. e hot weather cuts down on disease spread. The nate is relatively mild well up into the winter— ich is another good thing.

I started on my farm unit before there was ter available for irrigation, so I put in wheat l raised a crop on the natural rain. I did not ve too much to do until the crop was harvested so I raised turkeys. The year of 1948 was one of the best turkey years on record; consequently I did well. I did have my mother, father, and wife to help me the first two years, but the past two years the wife and I have done it alone.

Starting the poults is the biggest problem. The first thing is to get good stock, and then sleep with them for the first week. To eliminate trouble later we clip the last joint off one wing as we take them out of the box. This keeps them from flying later on. The next thing we do is to dip their beaks into water to help them to get started drinking and eating. One nearly always has to teach some of them to eat and drink.

We then put the poult under the brooder which has been running for two or three days to be sure it will hold to the right temperature for the young poults—95°, decreasing the temperature 5° each week until they are about five weeks old.

We use several tricks to help the poults to eat and drink. We start them on clabbered milk the first day. Then we fill the jars with water without washing them so the water will be cloudy.

USE FOR THANKSGIVING—The Glen Eppich family (below) give nks, not only for the turkey, and a good harvest from their co unit of the Columbia Basin project. They are most thankful little Lee, age 3, is again walking with the aid of a brace r being crippled by polio. The turkey on the Eppich table may e come from O. C. Gillum's flock (at right). *Photo below by E. Foss, photo at right by F. B. Pomeroy, both of Region 1.*

After that we wash the jars often. We spread the first feed out on white paper or egg case dividers. In short, one feeds the turkeys by their eyes and not their taste. Never change feed or even the placement of water or feed containers rapidly. Do it a little at a time. If they see anything new or different they will not like it. They must be afraid there might be a "booger man" in or around anything strange.

We soon found that there is a lot of work to raising turkeys and any labor-saving device was a big help. We built sun porches for the poults to run out on after they were 10 days old—but we kept the brooders going so the turkeys could run to the heat if they got cold. The sun porches gave them more space to run and kept a lot of the manure on the outside. We put feeders on the outside so they could be filled easily and we would not have to go among the poults. We have automatic float valves which keep the water containers full all of the time. Turkeys need plenty of fresh clean water.

We use a commercial feed, as it contains a better balanced feed than we could get together easily. Within the last few years Vitamin B-12 and byproducts of medicines have been added. These make the poults grow faster and stay healthier. As a result we get more economical growth and lose less birds due to disease.

At from eight to ten weeks we put the turkeys on open range. It is good to have an acre to the hundred, but we have had 1,600 on 3 acres and they did well. Four things are necessary on this range. First, the ground must be dry, and disease free, and should have been cultivated or at least not ha turkeys on it the previous year. Second, plent of good water. Third, plenty of feed availabl Fourth, plenty of shade, as turkeys will pile u and smother each other looking for shade. Roost are desirable but not necessary. If you put a ligh over the roosting place, a lot of turkeys will avoi injuries, since a turkey is afraid of anything tha he cannot see.

Before going on this range the poults are vac cinated for fowl pox and a portion of the uppe beak is taken off. This is to keep them fro peeking each other. A turkey seems to be som what of a cannibal and will peek his fellow turk

You can raise the poults more economically i you have good pasture such as alfalfa to run the on. If this cannot be done easily, then put ou bales of alfalfa if the turkeys are not debeaked and hammered alfalfa if they are debeaked. The cannot eat alfalfa out of a bale if the debeaking ha been done.

After the poult is three weeks old, success de pends on keeping feed, water, and grit before hi We feed them commercial pellets which contai high protein, crystal grit, and grain. Oats ar good, especially until the poults are well feathere as oats help feathering. Pin feathers on a dresse turkey knock down the grade. Other grains ar also used. Some use wheat, but I prefer cor since I was raised in the corn belt.

GILLUM'S TURKEYS—Loudly objecting to the rumor they ju heard—that they will grace tables in the Pacific Northwest com Thanksgiving this year. *Photo by F. B. Pomeroy, Region* photographer.

The turkey is marketed as a turkey fryer or as mature bird. I prefer to sell the mature bird. We sell some to killing plants and dress and sell many locally. Seven months is the average time from day-old until the bird is sold. This gives us five months free from turkey care.

If you are thinking of going into raising turkeys, here are a few things you should know. A turkey is one of the smartest dumb birds ever seen. They are so dumb that they will actually starve to death rather than change feed or places rapidly, and yet they can out-smart a human in many ways. A turkey is a past master at ways of getting hurt or killed. If there were 100 ways of committing suicide known to humans, a turkey would find 110. Never leave a place in the fence or gates where he can catch his head. A turkey just naturally likes to stick his neck out to eat or look at something. If he gets his head caught he will just stand there and pull back till he dies. Remove everything that you think could possibly hurt a turkey and he will still find many more.

There are many turkey diseases and you have to be on the lookout for them all of the time. Blackhead is probably the worst. If a poult won't eat and looks droopy, it is time to look him over and perhaps remove him from the flock till you see what is the trouble. There is one other thing that a turkey raiser must look out for and that is the coyote—both varieties—the two-legged as well as the four-legged kind.

Raising turkeys is a crazy but fascinating game. I have had a lot of headaches but the money I've made on them sure helps. THE END.

Alaskan Survey Crew Rewarded for Courage

In mid-September Secretary of the Interior Oscar L. Chapman rewarded a team of six Reclamation survey men and one guide with either salary promotions or medals for ingenuity and courage they displayed the previous summer in the face of extreme danger during a survey party in search of a power dam site on the Susitna River in Alaska.

Those receiving salary promotions were Daryl Roberts and William Weber of Juneau along with Edwin Stewart of Palmer. These three are still in the employ of the Bureau. The others, no longer with the Bureau, who received silver medals and certificates of meritorious service from the Secretary, were Ada E. Jaskar and Harry Johnson of Juneau, Terrence L. Robbins of Palmer, and Frank Swanda, the guide, of Anchorage.

The men were shipwrecked as they passed the mouth of the Oshetna River, lost their boats and all their supplies and equipment, except that which they salvaged after safely reaching shore. Among their resourceful devices to survive the subarctic region, were fish hooks made out of paper clips. With these, plus rods and tackle improvised from willow poles, blasting wire and shipping tags, they caught 74 fish during their 6-day-long vigil, first using horseflies, then fish eyes and cut fish for bait. Despite their ordeal, they managed to obtain useful survey data on the area by the time they were rescued by an Air Force plane. •

Davis Dam Nears Completion

The last major contract in the building of Davis Dam and power plant was awarded on September 6, 1951, when Secretary of the Interior Oscar L. Chapman announced that the Grafe-Callahan Construction Co. of Los Angeles was the successful bidder for the job of completing the dam's spillway stilling basin.

Work is scheduled to begin by the 6th of October 1951 and should be completed in April 1953. The contract provides for completing the concrete basin structure, excavating a spillway outlet channel, and improving the channel of the Colorado River.

The stilling basin will control the force of waterflow at the spillway and thus insure safety to the dam and powerhouse, as well as prevent downstream damage in the event of an unusually heavy flood.

Davis Dam, located on the Colorado River near Kingman, Ariz., is one of the four key structures built by the Bureau of Reclamation for the control and multipurpose use of the downstream flow of the Colorado River. The others are Hoover, Parker, and Imperial Dams.

Besides producing power, Davis Dam also regulates the irregular water releases from the Hoover power plant for the benefit of irrigated areas downstream and will facilitate water deliveries beyond the boundary of the United States as required by the treaty with Mexico. •

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OR YOU'LL FLOOD YOUR CROP. This bean field near Newman, Calif., could have been saved through proper drainage.

don't waste water

by PROFESSOR F. J. VEIHMEYER,
College of Agriculture, Davis, Calif.

ALMOST EVERYONE PICTURES the construction of dams to impound water or some phase of watershed protection as a means of conserving water. Certainly any method which will hold the water in storage during the rainfall period for release later where it can be put to use is a direct measure of conservation. It is apparent that savings can be effected by cutting down evaporation and seepage losses in conveyance of water to the points of use. These enterprises generally require a community effort and the cooperation of State and Federal agencies.

When we consider that more than nine-tenths of all the water used in California is for irrigation, there is much that can be done by individual water users to conserve it. The efficiency of irrigation, which is defined as the difference in the amount of water applied to the land and that held in the soil within reach of the roots, is surprisingly low in many parts of the State. Many areas do not have efficiencies as high as 60 percent. The 40 percent which represents waste is lost by evaporation, run-off at the lower ends of the fields, or by percolation below the depths of the roots of the plants. Much of this waste can be eliminated by the proper preparation of the land. The regulation of the length of runs and the width of checks to conform with the size of streams available and the slope and infiltration capacity of the soil are means of cutting down some of the losses.

It cannot be expected, of course, to eliminate all losses because some are inevitable. For instance, evaporation takes place during the time the water is being applied so long as the surface of the soil and plants are wet. This loss may amount to as much as 1 inch in depth of water for each application. Conveyance losses can be reduced by lining ditches and installing concrete pipe systems. Where topography, soil, and kind of crops being grown are suitable, water may sometimes be conserved by sprinkler irrigation.

The statement that losses usually amount to about 40 percent of the water applied may seem surprisingly great. In many instances, it has been found to exceed 50 percent, that is to say, over half of the water is wasted. Most of the trouble in

MAKE EVERY DROP OF WATER COUNT. Above, a farmer places checks in the furrows to hold back the water and make certain it penetrates properly to the root zones of the grapes he is raising near Fresno, Calif. At left, a Lompoc, Calif., farmer shows how he cuts down on evaporation and seepage losses. He is using portable pipes to irrigate a field which will be planted to carrots.

igated agriculture is the use of too much water her than too little. The fact that excessive ounts of water are being used is illustrated by recent report of one of the best California irri- ion districts which states that over 100,000 acre- t were pumped for drainage—and this is not the al amount of waste since all of the wasted water s not pumped. This is not intended to be a ticism since this district has ample water and system is designed to supply large streams of ter to irrigators with minimum expenditure of or for application. It does, however, result in ge seepage losses.

A series of events follow the rise of the water le close to the surface of the soil. It has been d that habitation under an irrigation ditch is t possible without natural or artificial drainage. is need not be true if irrigationists will follow od practices and rational schedules for applying ter. Before discussing this in further detail, it uld be pointed out that most of the water ap- ed to the soil is taken from it by plant transpiration and only a small portion is evaporated directly from the soil surface. This evaporation takes place from a layer of surface soil which rarely exceeds 6 inches in depth. When the water table is raised close to the surface, however, the loss by evaporation increases very rapidly. For instance, with the water table 1 foot from the surface, the loss is almost equal to the evaporation from a free water surface. When water reaches the surface of the soil and evaporates, the salts it contains are left and the increased salinity may reach a concentration high enough to become destructive to plants and soils. Examples of the deterioration of irrigated areas due to the wasteful use of water with resulting rise of the water table close to the soil surface are common throughout the world.

One reason for the low efficiency in irrigation or, saying this in another way, the large waste of water involved in irrigation, is due to the belief that best conditions for the growth of plants occur when the soil moisture is kept at a high level. This belief is not founded upon facts. Greater growth is not produced by frequent irrigations as compared to infrequent ones. Examples of the waste of water can be seen all over California. For instance, cotton frequently is irrigated 8 to 10 times. Sugar beets, tomatoes, alfalfa, and orchards are irrigated much more frequently than necessary.

The soil, in fact, may be considered as a reservoir for water. The amount that can be held in this reservoir is limited by the kind of soil, and each soil has a certain moisture content below which water cannot be taken from it. The interesting thing is that moisture is equally available to plants between the upper and lower limit and, furthermore, plant growth is not increased by maintenance of large amounts of water in the soil.

Our experiments in California show that for most deciduous orchards two or three irrigations are ample. For cotton, three applications usually will suffice to produce maximum yields. The savings on the 1,200,000 acres of this crop to be planted this year could be very great. Alfalfa need not be irrigated more than once between cuttings on soils with high water-holding capacities. If the irrigation schedule is laid out in accordance with the moisture properties of the soil and the depth of the rooting of the plants, certainly water can be conserved, if only enough water is applied to the soil to refill the soil reservoir when it is depleted. It is common observation that most farmers apply the same amount of water at each irrigation. If 40 to 50 percent of the water is lost each time, it is obvious that considerable savings can be obtained by reducing the number of irrigations. Indeed the irrigated area in California almost can be doubled without increasing the demand for water if this wasted water were conserved.

Some plants have characteristics which necessitate wasteful use of water. Experiments with lettuce in one of the coastal areas of California show that the maximum use of water by one crop amounts only to about 4 inches, while frequently some 3 to 4 feet of water are applied. Consequently it is usual to find standing water at a depth of about 5 feet in most of this area. Lettuce plants have sparse root systems, most of which are in the surface soil. In order to keep them provided with water, frequent applications may be necessary, since generally it is impractical to put on very light applications by surface means. Irrigated pastures are another example of crops which take large amounts of water. Usually the use of water for irrigated pastures may be two or more times that for alfalfa.

While domestic and industrial uses of water at the present time are very small compared to agricultural use, savings can be effected. Much of the water used in cities is for irrigation of lawns. Measurements have shown as much as 2 or 3 times more water is applied than is actually required. The increased use of evaporative coolers is another source of waste of water.

In the over-all consideration of water consumption, it should be kept in mind that industry and urban uses of water must go hand in hand with agricultural developments. Some attention, therefore, should be paid to the desirability of applying water to shallow soils and to soils of very low water-holding properties. Would it not be better to deny water to poor lands and to use it for domestic and industrial purposes if the total supply in a given area is not sufficient for all purposes?

Much of what has been said is to stimulate thought on the part of the water user toward the part he may play in conserving water. I believe that through education and demonstration, much can be accomplished to help individuals in eliminating excessive wastes of water, and it may not be overly optimistic to say that much more land can be irrigated with the same water supply we now have if the water is used in a rational way with efficient methods of application on well prepared lands.

THE END

V. F. W. Searching for Ideal Veteran-Farmer

A Nation-wide search is under way by the Veterans of Foreign Wars to select the most worthy qualified veteran who will receive a $50,000 farm on the Columbia Basin reclamation project next spring.

The farm will be transformed from raw, sagebrush covered land into a going farm in one spectacular 24-hour operation as a part of the celebration the Columbia Basin Commission is planning next May in connection with the first delivery of water from the Grand Coulee equalizing reservoir.

Veterans are urged to contact their nearest local V. F. W. post for details of the search and to determine if they are eligible for consideration. ●

INHIBITING ALGAE IN ARIZONA (at left) by large-sized spray loaded with Rada. Below, masses of moss (see arrows) at Yuma's Boundary Pumping Plant being pulled up by weed hooks, before Rada made the job easier. *Photos by the author.*

RADA for ALGAE*

(*pronounced AL-jee)

by CURTIS BOWSER, Weed Specialist
Region 3 headquarters, Boulder City, Nev.

RADA, or Rosin Amine D Acetate, has saved housands of dollars, by putting an end to algae, ommonly called blanket moss, frog moss, pond cum, water net, or just plain moss.

Late in the summer of 1946 and during early pring of 1947, reddish-blue strands or thread-like laments of a plant, identified as Compsopogon pecies, red algae of tropical or subtropical distriution, began collecting upon the trash racks at he Boundary Pumping Plant which is located at he terminal end of the Valley Division drainage ystem of the Yuma project in Arizona. At this oint, drainage water from some 90 miles of interonnecting drains, which serve this 50,000 acre ection of the project, is taken from the ditch and ifted several feet into Mexico for subsequent dilution and reuse. The quantity of plant material ollecting was not considered serious, although wo men were required to keep the intakes free when the pumps were operating. This condition ersisted for several months each summer but with ool weather in the fall the quantity of material ollecting slowly decreased.

Fresh water algae follows a definite cycle of rowth, depending on the intensity and duration of sunlight and its attendant effect upon water temperature. The troublesome red algae in the Yuma drainage system responded as a summer annual, and again in early spring 1948 the filaments began collecting. The seriousness of the problem was realized during the summer months when two to five workmen were required each shift to keep the gratings free. The peak was reached in July when for a period of several days a labor force of fourteen men was detailed during the day shift to remove algae which collected in great quantities when the pumps were operated at capacity. During this peak period, up to 18 dump-truck loads of algae growth were removed during the day shift with lesser amounts during other periods when pumping was reduced.

In general appearance, the algae filaments floating in the water resembled miniature evergreen trees without symmetry or a central stem, as the strands or threads were branched and rebranched. These masses of vegetative material were not attached to the soil but would drift idly in the water, collecting upon snags or resting in ponded areas until such volume had developed that by sheer drag in the current the mass would tear loose to continue on its downstream course. Some filaments floated near the surface, and others with less buoyance, because of intertwined debris, rolled as a mass upon the bottom of the drain and as a result the trash racks were blanketed evenly with algae from top to bottom.

Consideration was given to every possible method to escape the high cost of labor required to clean the trash gratings. The laborers also were interested in a more practical solution of removing the collecting filaments as it was no light task to wield a 14-foot-long weed hook, which often would bite into a greater quantity of debris than could be lifted. The installation of a mechanical trash remover was considered but to handle the volume of material in this large ditch would require a device of considerable size and elaborate design. Removing the trash gratings to allow the debris to pass through the pumps was believed practical until, on trial with one of the smaller pumps, it was shown that the long-clinging filaments would not pass through the bell casing but simply matted and twined about the impeller shaft. Installation of a nonclogging trash pump also was discussed. However, as with other weed problems, it appeared most logical to attack the problem at its source.

Treating the water with chemicals was considered and preliminary tests with the common algaecides were undertaken. Although these chemicals were toxic to the algae, use of the materials could not be recommended considering the quantity of water to be treated.

Research personnel in the weed-control laboratory of the Chief Engineer, Bureau of Reclamation, in cooperation with technicians of the Hercules Powder Company, reported that a primary amine derived from a specially modified rosin had proved to be a very active algaecide. This product under the trade name, Rosin Amine D Acetate (or RADA for short) does not possess any undesirable characteristics, is very inexpensive, and is marketed in a form ready to apply when mixed with water.

The first introduction of this new algaecide into the drains on the Yuma project during the early spring of 1949 was followed immediately by dragline operations in the drainage system. The resultant roiling of the water, combined with the chemical, deterred growth of algae during most of the season.

There was some question as to whether the turbid water or the chemical had suppressed the algae, but all doubt disappeared following re-treatment of the drainage system with RADA during the spring of 1950 at a period when the water was quite clear. At that time applications of RADA were made at rates of 10 parts per million for 15 minutes contact time at 2-mile intervals through the main stem of the drain. Effects of the chemical were apparent immediately as the quantity of algae collecting on the trash racks decreased appreciably. Although a huge quantity of debris still was being forked from the racks, the algae filaments were waterlogged and lifeless and did not possess the sheen or resilience of healthy vegetation. Several days later the labor force could be transferred to another activity. Thereafter, periodic cleaning of the grates, a routine practice several times each shift, was easily handled by the pump operators.

For trial testing it is suggested that 10 parts per million RADA for 10 minutes contact period be used, although this dosage may prove to be greatly in excess of the minimum amount required to destroy most algae in irrigation systems. The distances between introduction stations will of course depend largely upon water velocity and density of plant growth. In all probability, under favorable conditions the chemical will carry and be effective for many miles. No special equipment is required to make introductions of RADA—simply use similar equipment and apply in a manner comparable to that recommended for using aromatic solvents. This algaecide is not effective in suppressing rooted aquatic vegetation. (Use of chemicals to suppress submerged aquatic weeds in irrigation systems was discussed in the May 1948, and April and May 1950 issues of Reclamation Era.)

Rada Saves $2,200

Rosin Amine D Acetate may be a solution to your algae problem. Consider the one situation of the Yuma project Main Drain where chemical applications now are made each spring and fall as a routine practice in preventing a build-up of the algae population. The cost of hand labor to remove the plant growth during 1948 alone was in excess of $2,500. Positive relief from the undesirable plants was accomplished during the 1950 season through use of RADA at a total cost of only $300, a saving of $2,200. Previons time-consuming, back breaking hand labor cost more than eight times as much as the RADA treatment.

This is one of the many refinements in plant suppression techniques which are being realized through the program of coordinated research from the laboratory investigational stage of new products through to field applications bringing about more practical, time-saving and economical solutions to weed problems. The End.

WATER REPORT

y R. A. WORK, Senior Irrigation Engineer, and LYDE E. HOUSTON, Irrigation Engineer, both of e Soil Conservation Service, United States Depart- ent of Agriculture.

Recent and widespread discussion in the na- nal press has resulted from apparent differences ' interpretation as to current status of western ater supply, particularly stream flow in Colum- a River Basin. The flow of this mighty river t only is used for irrigation and navigation but r generation of huge blocks of hydro-power by ivately and publicly owned utilities. It is in rect connection with power generation that na- onal interest is now sharply focused upon this ver, since the productivity of certain vital indus- ial plants is dependent upon availability of large ocks of low-cost water power. The authors' pur- se in thus briefly mentioning this Columbia iver situation is merely to illustrate the growing portance to industry of dependable water sup- ly. Now, actually, the flow of the Columbia at e time of this writing differs very little from hat was anticipated several months ago. Read- s of May 1951 Water Report will recall the en spotty outlook for western water supplies— enerous water supplies in prospect for the Pacific orthwest ranging to drought conditions foreseen r Arizona, New Mexico, and southern Utah. s to the main Columbia itself, as gaged by its ow at The Dalles, Oreg., the early spring fore- sts of 1951 were closely verified as follows:

Gaging station	Obtained [1] acre-feet	Forecast for April–September			
		Apr. 1		May 1	
		Acre-feet	Error percent	Acre-feet	Error percent
olumbia—The Dalles	109,901,000	110,000,000	0	108,000,000	2

[1] Data of stream flow are provided by U. S. Geological Survey: are pre- iminary only and subject to revision.

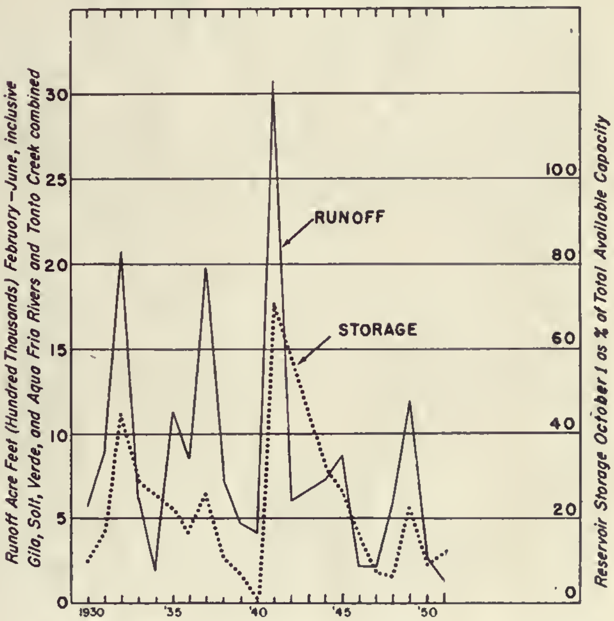
[1] The Division of Irrigation and Water Conservation is the ederal coordinating agency of snow surveys conducted by its aff and many cooperators, including the Bureau of Reclamation, her Federal bureaus, various departments of the several States, rigation districts, and private agencies. The California State ivision of Water Resources, which conducts the snow surveys that State, contributed the California figures appearing in this ticle.

However, before turning to a general review of outcome of the forecasts for the season just concluded, a brief peek into the prospects for 1952 is of concern. In the following paragraphs, the Division of Irrigation and Water Conservation, Soil Conservation Service,[1] describes the results of its October 1 survey of the reservoir storage and soil moisture situations throughout the West and compares the 1951 run-off of western streams with that which was forecast from the April and May 1951 snow surveys.

So far as water held over in storage is concerned, the outlook is not uniform. Storage reserves are very poor through the Southwest, particularly in Arizona, New Mexico, and Texas, but improve to the north. Reserves are average or better in California, Nevada, Utah, and Washington, and range up to excellent in Idaho, Montana, and Wyoming.

The prolonged western dry spell of 1951, broken here and there by spotty above-normal rainfall, may unfavorably affect watershed soil priming. In such case, snowfall of average proportions in 1951–52 will produce run-off of less than average proportions next season. There still is time,

ARIZONA'S SURFACE WATER SUPPLY
for 22 years (1930–1951 inclusive)



through October and November, to receive heavy rains which will better prime the watersheds in advance of their winter snow blanket.

Here is a brief résumé of the storage situation:

ARIZONA.—During the past summer, reservoir storage dropped to less than 1 percent of capacity, but heavy rains in August brought it up to 12 percent. If greater than normal snowfall is not forthcoming this winter, the outlook for next summer will be for a critically short water supply.

CALIFORNIA.—As the opening of the rainy season is approached, California has in storage, in major Sierra reservoirs, a 4 percent smaller suppiy than carried forward at the same date last year. Thus, 25 reservoirs serving the Sacramento and San Joaquin held 4,380,260 acre-feet on September 30, 1951, or 55 percent of capacity as compared with 4,581,200 acre-feet and 58 percent of capacity on September 30, 1950. The 1951 storage is normal as compared to records for the 10-year (1940–49) period.

Watershed	Number of reservoirs	Capacity	Water stored Sept. 30	
			1950	1951
Sacramento	1	4, 366, 800	2, 702, 000	2, 431, 400
Feather	4	826, 800	632, 600	624, 580
Yuba	3	244, 800	153, 900	136, 260
Bear	1	7, 200	1, 700	2, 190
American	2	30, 200	19, 900	16, 260
Mokelumne	2	349, 000	271, 000	271, 120
Stanislaus	3	145, 500	32, 900	25, 430
Tuolumne	3	676, 800	356, 000	373, 860
Merced	1	281, 000	16, 900	17, 270
San Joaquin	5	854, 400	268, 400	355, 990
Total	25	7, 915, 700	4, 581, 200	4, 380, 260

COLORADO.—The outlook for next season in the South Platte Valley is improved over last fall since carry-over in irrigation reservoirs is slightly above average. On the west slope and in southern Colorado, the picture is not so bright as there is no carry-over storage in San Luis Valley. October 1 storage in 48 reservoirs in Colorado was 34 percent of capacity and the past 10 year average storage for that date was 40 percent of capacity.

IDAHO.—Carry-over storage is good. October 1 storage in Idaho reservoirs was 59 percent of capacity while the past 10-year average was only 32 percent. Average snowfall during the winter months should insure next season's irrigation water supplies.

MONTANA.—Reservoir storage for the Missouri and Columbia River Drainages in Montana is well above average. October 1 storage in 21 representative reservoirs is 75 percent of capacity and 25 percent greater than the past 10-year average.

NEVADA.—Reservoirs stored about 60 percent of capacity and greater than normal for the fall season. Highest storage is in the Sierra and lowest in the central and eastern portion of the State.

Reservoir	Capacity, acre-feet	Active storage Oct. 1	
		1951, acre-feet	1940–49 average, acre-feet
Wildhorse	32, 690	9, 483	10, 794
Rye Patch	179, 000	85, 300	116, 039
Bridgeport	42, 455	20, 113	16, 247
Topaz	59, 440	16, 918	18, 450
Lahontan	290, 900	110, 000	138, 281
Tahoe	732, 000	531, 600	408, 262
Boca	40, 900	27, 800	24, 597

NEW MEXICO.—Storage in the major reservoirs including El Vado and Elephant Butte approaches zero. Six major reservoirs with a total capacity of 3,629,800 acre-feet contained about 250,000 acre-feet on October 1. Last year at this time, these 6 reservoirs stored about 800,000 acre-feet. Unless mountain snow accumulation during the 1951–52 season is well above normal over the whole Rio Grande watershed, another year of severe wa shortage may be expected.

OREGON.—Twenty-three reservoirs stored water at percent of capacity on October 1 and at 85 percent of past 10-year average. Greater than normal snowfall needed during the coming winter to guarantee adequ irrigation water supplies for several sections of Oreg

UTAH.—In northern Utah, October 1 storage is 61 p cent of capacity, while in the central and southern p of the State. it is only 7 percent. For the State as whole, storage as of the above date is 54 percent of cap ity and nearly 25 percent above average.

Reservoir	Capacity, acre-feet	Oct. 1 storage, acre-	
		1951	1940–4 avera
Bear Lake	1, 420, 000	1, 102, 200	766
Deer Creek	147, 700	117, 700	70
East Canyon	28, 730	12, 725	14
Echo	73, 900	38, 400	20
Hyrum	15, 300	5, 600	5
Moon Lake	35, 800	11, 900	8
Pineview	44, 200	13, 400	13
Strawberry	270, 000	132, 700	68
Utah Lake	850, 200	350, 900	343
Otter Creek	52, 500	2, 080	23
Piute	84, 750	1, 320	10
Rocky Ford	23, 300	2, 490	9
Sevier Bridge	236, 000	0	101
Scofield	65, 800	26, 700	8

WASHINGTON.—Washington is entering the snow s son with reservoirs storing about 41 percent of capaci This is comparable to the average stored supplies on t date for the past 10 years.

WYOMING.—In general, storage water in Wyoming r ervoirs is above average. For 10 representative res voirs, storage on October 1 was 69 percent of capacity a about 65 percent greater than the past 10-year average

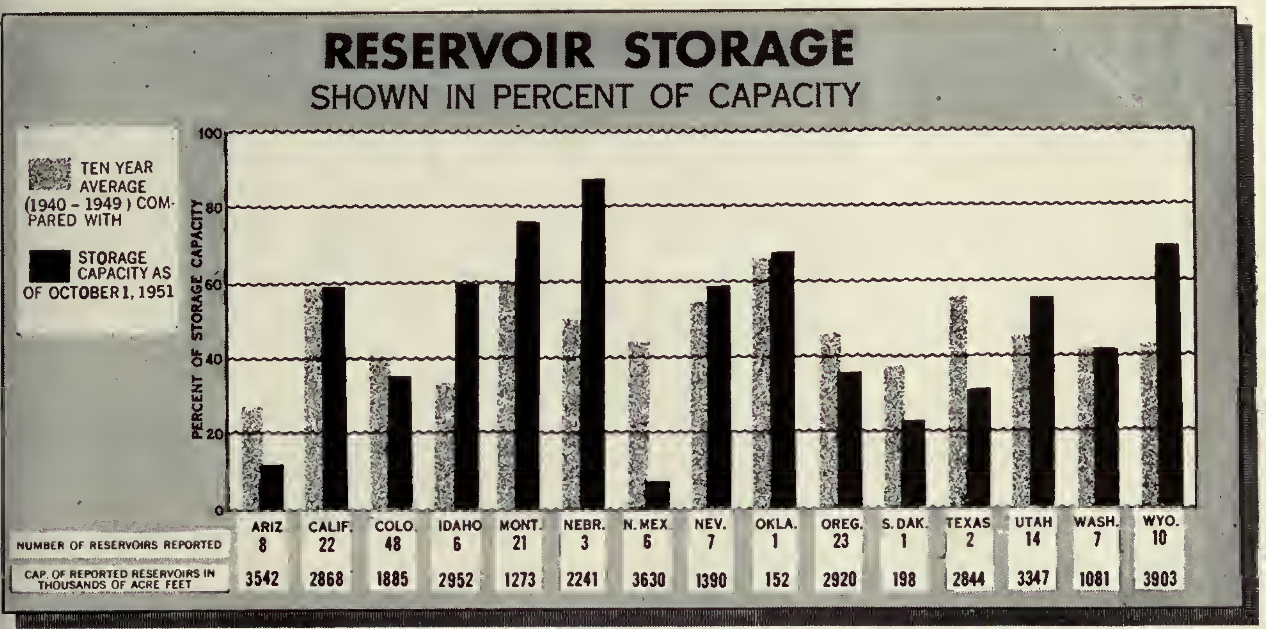
Accuracy of 1951 Run-off Forecasts

Departures of actual stream flow from t amounts forecast from April snow surveys we of greater than usual magnitude in certain regio in 1951 due to under- or over-estimation of t soil priming factor. At least, analysis of resu seems to indicate this as the basic cause of err The snow surveyors are now recasting their for cast formulas for certain basins in view of 195 experience, and water users should correspondin profit in future years through improved forecas

ARIZONA.—During the last week of August, a gene storm occurred throughout most of the State. Up to inches of rain fell on the watersheds in a 4-day peri Coming at a time when the State's total reservoir stora had dropped to a pitiful low of 8,000 acre-feet, this sto was providential. It brought about 350,000 acre-feet water into thirsty reservoirs. While this storage w still only a fraction of capacity, it meant the differe between continued drought conditions and ability of far ers to plant fall vegetables and grain crops with so degree of security. Stream flow during August was abo normal on all rivers. The Tonto ran over 1,700 perc normal. However, stream flow during all the sum months has been only about 50 percent of normal.

Soil moisture conditions on range lands and fore were improved by this storm. However, precipitat during September was below normal and temperatu above normal. Consequently, some watershed drying since occurred. These rains also renewed life in so mountain springs but did not affect the ground water le under most of the pumped areas. Water tables are ste ily dropping.

The chart on page 249 shows the October 1 resid



Most State averages are for full 10-year period, but in a few cases, reservoirs having shorter records are included.

CALIFORNIA—Does not include Millerton or Shasta Reservoirs. October 1 storage in these two reservoirs combined was 2,702,900 acre-feet or 54 percent of capacity. COLORADO—Does not include John Martin Reservoir. October 1 storage was 59,300 acre-feet or 9 percent of capacity. MONTANA—Does not include Fort Peck Reservoir. October 1 storage was 13,990,000 acre-feet or 74 percent of capacity. Does not include Flathead Lake with October 1 storage of 1,773,000 acre-feet or 99 percent of capacity. NEVADA—Does not include Lake Mead. October 1 storage was 19,118,000 acre-feet or 70 percent of capacity. WASHINGTON—Does not include Roosevelt Lake. October 1 storage was 5,220,000 or 100 percent of capacity.

storage for each year from 1930 through 1951 for the 8 principal irrigation reservoirs of Arizona. Also shown in the figure is the spring run-off combined for the principal streams used for irrigation. It is to be noted that residual storage October 1, 1951, is only 50 percent of average and 11.9 percent of capacity. Looking backward, only in 1940 and 1948 were October 1 storage reserves appreciably less than those of 1951. 1941 showed big spring run-off. 1949 showed fair spring run-off. Will 1952 spring run-off be sufficient to "bail" Arizona out? 1952 spring snow surveys will provide the answer.

The outcome of the Arizona forecasts in 1951 is shown below. The actual flows obtained exceeded forecast amounts because of early summer rains in mid-May.

Stream	Obtained[1] acre-feet	Forecast for February–June: March 1 Acre-feet	March 1 Error, percent	Apr. 1 Acre-feet	Apr. 1 Error, percent
Gila	27,350	20,000	27	22,000	20
Agua Fria	0	0	0	0	0
Salt, Tonto, Verde	133,680	120,000	10	127,000	5

[1] Preliminary only, subject to revision.

California.—On April 1, run-off from the Sierra snow pack was expected to be less than 65 percent of normal. Weather conditions during April slightly improved the May 1 over-all expectancy. However, run-off during April–July greatly exceeded that forecast either on April 1 or May 1. This was particularly true on the Kern and Kaweah watersheds where the April 1 forecasts pointed toward the smallest summer flows since the start of snow surveys in 1930. Although the forecast run-off was exceeded on each of these watersheds, flows for the period were still below normal.

The reason for the discrepancy of forecast flow from that obtained appears to be that sufficient consideration was not given to delayed run-off from the extremely heavy rainfall of November and December 1950. It is now indicated that rain which then fell resulted not alone in the extreme floods of that date, but also imparted an extremely heavy soil priming water charge to the soil mantle. This soil moisture later froze during the winter and when the spring temperatures rose, again started moving into the stream channels. This then accounted for a large percentage of the summer flow carried in the Sierra streams during the 1951 snow-melt period.

It will be noted in the tabulation below that the greatest accuracy of forecast was obtained on the extreme northern Sierra streams in the area not so affected by the heavy fall storms.

Gaging station	Obtained[1] acre-feet	Forecast for April–July, full natural flow: Apr. 1 Acre-feet	Apr. 1 Error, percent	May 1 Acre-feet	May 1 Error, percent
Sacramento River into Shasta Reservoir [2]	1,474,200	1,500,000	2	1,350,000	8
Feather River near Oroville	1,500,500	1,500,000	0	1,400,000	7
Yuba River at Smartsville	890,200	775,000	13	725,000	19
American River at Fair Oaks	1,039,000	750,000	28	820,000	21
Mokelumne River near Mokelumne Hill	353,300	250,000	29	250,000	29
Stanislaus River below Melones	531,500	370,000	30	350,000	34
Tuolumne River at La-Grange	928,500	750,000	19	750,000	19
Merced River at Exchequer	453,800	325,000	28	350,000	23
San Joaquin River at Friant	920,400	725,000	21	750,000	19
Kings River at Piedra [2]	853,700	600,000	30	600,000	30
Kaweah River near Three Rivers [2]	171,500	65,000	62	90,000	48
Kern River near Bakersfield [2]	263,000	80,000	70	110,000	58

[1] Preliminary only, subject to revision.
[2] Impaired flows—not full natural flows.

Colorado.—Irrigation water supplies in Colorado followed the pattern indicated by the snow accumulation last spring. In the South Platte Valley and on the Up-

(Please turn to page 260)

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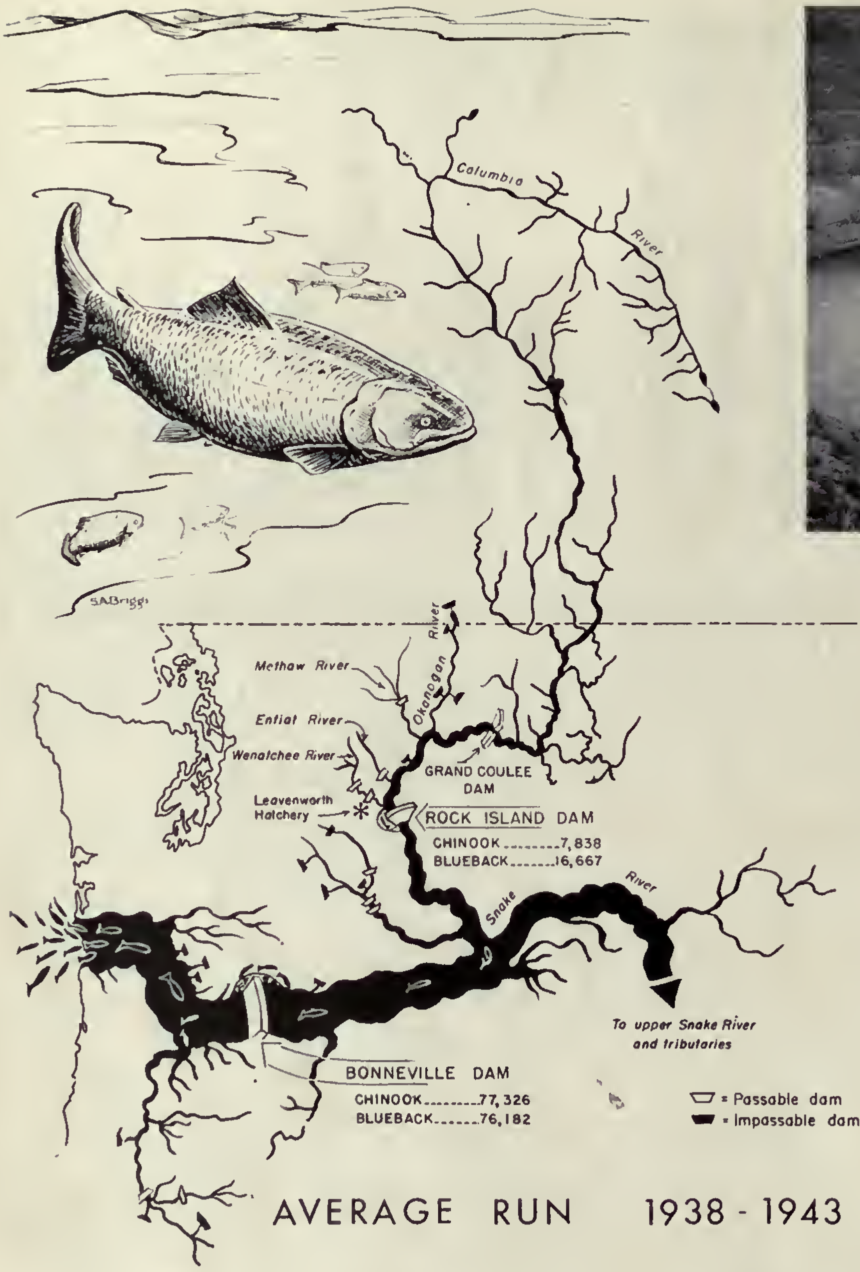
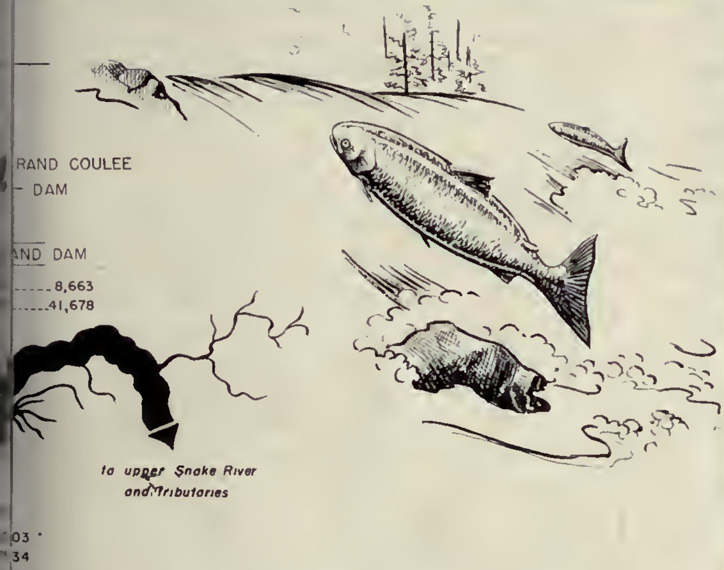


SALVAGING SALMON AT

by C. J. BURNER, Chief, North Pacific Fishery Investigations, Fish and Wildlife Service, Seattle, Wash.

THE STEEL AND CONCRETE CURTAIN that fell on the Columbia River salmon runs at Grand Coulee in 1939 marked "finis" to spawning areas where mating, egg-laying, and rearing had taken place for countless decades. A gigantic dam blocked the home streams of a portion of the salmon runs then worth 300,000 dollars a year and valued at considerably more now. With little more than the "Home Stream Theory" upon which to base their efforts, the U. S. Fish and Wildlife Service turned this unhappy picture into a successful experiment in salmon relocation. Here is how it was done.



AFTER FIVE YEARS' OF FREE RIDES salmon got used to new homes. Map at far left shows former spawning grounds north of Grand Coulee Dam. At immediate left, present restricted area. Drawing by Shirley Briggs, Grophics Section.

RAND COULEE

UNDER-STOCKED STREAMS below Grand Coulee Dam (top page 252) became new homes for displaced salmon. Trapped at Rock Island Dam, given an elevator ride and dumped into a fish-tank truck (top center), some were artificially spawned at the Leavenworth Hatchery (upper right) while others were hauled directly to their adopted "home stream" for natural propagation. At lower right, an employee in the Leavenworth Hatchery checks eggs.

Grand Coulee Dam, 550 feet high, was the culmination of years of planning by citizens of eastern Washington and the Bureau of Reclamation to build a dam across the Columbia and pump a portion of its run-off into the nearby Grand Coulee for purposes of irrigating the great expanses of

Fish Counts at Bonneville and Rock Islands Dams

CHINOOK [1]

	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	For years 1938–43	For years 1944–50	For years 1938–50
														average	*average*	*average*
Bonneville	42, 648	100, 155	88, 344	88, 718	65, 108	78, 984	43, 469	71, 135	118, 531	172, 422	108, 965	96, 806	106, 893	77, 326	102, 603	90, 937
Rock Island	5, 803	11, 206	9, 492	2, 571	6, 814	11, 145	3, 375	5, 696	9, 992	11, 766	7, 095	12, 350	10, 365	7, 838	8, 663	8, 28
Percent [2]	13. 6	11. 2	10. 7	2. 9	10. 5	14. 1	7. 8	8. 0	8. 4	6. 8	6. 5	12. 8	9. 7	10. 1	8. 4	9. 1

BLUEBACK

	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	For years 1938–43	For years 1944–50	For years 1938–50
Bonneville	75, 040	73, 382	148, 805	65, 745	55, 475	[3] 38,645	[3] 13,471	9, 501	74, 354	171, 139	131, 537	51, 444	77, 993	76, 182	75, 634	75, 88
Rock Island	17, 123	19, 591	28, 894	949	15, 782	17, 665	4, 932	7, 142	46, 563	79, 834	84, 627	18, 601	50, 047	16, 667	41, 678	30, 13
Percent [2]	22. 8	26. 7	19. 4	1. 4	28. 4	45. 6	36. 6	75. 2	62. 6	46. 6	64. 3	36. 2	64. 2	21. 9	55. 1	39.

[1] Bonneville counts are through July only. Few, if any, of the fall-run chinook migrate as far up the river as Rock Island.
[2] Percent Rock Island count is of Bonneville count.
[3] Does not include fish taken at Bonneville for artificial propagation.

fertile plains to the south, and at the same time to generate electricity at the dam.

In the burst of enthusiasm over this Northwest development, the salmon were nearly overlooked. The dam would isolate over 1,000 miles of spawning streams in the upper Columbia River. What to do with the displaced thousands of salmon ranging in weight from 2 pounds to over 50 pounds?

Because of Grand Coulee's height and fluctuating forebay, it was not considered practical to use fishways similar to those at Bonneville. In addition, there was no known method of preventing the small seaward migrating youngsters from getting killed by being swept down over the 350-foot chute-the-chute spillways.

In cooperation with several State agencies, the U. S. Fish and Wildlife Service (then the U. S. Bureau of Fisheries) proposed a plan to transplant the runs of "damned" salmon into tributaries that enter the Columbia River below Grand Coulee. The plan was based on the theory that salmon will return to the stream in which they were hatched or planted as fingerlings. The idea was to trap the runs at a point below Grand Coulee Dam and transfer the adult fish to streams that would remain accessible. There were two reasons for deciding upon this solution: (1) All of the fish which normally spawned above the Grand Coulee Dam could be stopped and trapped at Rock Island Dam, about 150 miles downstream from Grand Coulee. (2) Suitable tributaries into which the displaced salmon could be relocated were available in the Wenatchee, Entiat, Methow, and Okanogan Rivers. These mountain streams contained excellent spawning gravels and the runs frequenting them were badly depleted. In addition to the natural spawning area in these streams, the largest fish hatchery in the world was provided by the Bureau of Reclamation, together with a system of smaller hatcheries, to augment the salmon production.

Construction work began at Grand Coulee in 1933; but the dam did not become a barrier to salmon until 1939. In that year as the salmon migrated upstream, they were trapped at Rock Island Dam and hauled in 1,000-gallon tank trucks to the selected streams for natural propagation. Some were also hauled to the large Leavenworth hatchery for artificial propagation. These trapping and transporting operations were continued each year until the termination of the 1943 migration, a period of five years. This is long enough to cover the life-cycle of the salmon, which ranges from three to six years—most of them are four and five years old with very few returning in their sixth year.

The plan was to trap and haul the fish for five years and then to remove the traps at Rock Island Dam and let the salmon proceed upstream on their own power, without benefit of tank truck pullmans. Here was an opportunity to test the Home Stream Theory on a grand scale. Would these full grown offspring of the transplanted salmon return to the streams where they were hatched and reared, or would they attempt to migrate on upstream to the old spawning grounds above the dam? 1944 was the first year that the returns from these stocks were permitted to pass Rock Island. Fishery biologists waited anxiously and watched the salmon proceed upstream, mile upon mile. Finally the fish turned in to the new streams nd disregarded the open river up which their ncestors had proceeded for so many years! The lan worked! The home stream theory held true.

Data obtained since 1944 indicate that the program has been an unqualified success. In that ear 8,307 salmon passed Rock Island Dam and nly 6 were seen below Grand Coulee Dam. Because these latter were large chinooks, it is possible hat they were 6-year old fish of the 1938 brood hich were not relocated by the salvage program.

The real success of the Grand Coulee fish maintenance project in maintaining these runs in the pper Columbia River can be gaged by analyzing he number of fish which return over a period of everal years. The Columbia River runs have uctuated greatly from year to year, and the true easure of the project's success is the proportionate contribution of these upriver runs to the tal runs into the Columbia River. Such a measure may be obtained by comparing the counts of sh at Rock Island Dam with the counts of fish assing Bonneville Dam. Data for the past 13 ears are shown in the accompanying table.

Only an insignificant part of the runs of the rge and valuable chinook salmon passing Bonneville Dam after July 31 proceed as far upstream s Rock Island Dam. Thus in the table, the onneville counts of chinook through July only re listed. Since chinook salmon have mostly a and-5-year life cycle, the upriver run in 1944 as the first to consist entirely of transplanted ock. For the first 6 years (1938–43) the counts f the upriver runs of chinook have comprised rom 2.9 percent to 14.1 percent of the comparable scapement (number of fish in the spawning run hich escape) at Bonneville with an average of 0.1 percent. From 1944 to 1950, when the transplanted chinook were on their own, this ratio has aried from 6.5 percent to 12.8 percent with an verage of 8.4 percent. Thus it would appear that hese ratios are somewhat below the average for he years previous to the Grand Coulee program.

The blueback salmon present a different kind f story. These are the second most important pecies in the salvage operations. In the years 1938–43 the blueback averaged 21.9 percent of the Bonneville count and in the years 1944 to 1950 hey show a surprising 55.1 percent for an increase onsiderably above the average.

Species of anadromous fishes (those which return from the sea to spawn in fresh water streams) ther than chinook and blueback salmon are relatively unimportant in the Grand Coulee area. Silver salmon, once numerous, have an average count of 69 per year for the past 13 years. Steelhead trout runs have averaged approximately 2,700 fish per year for the same period. In 1938 the Rock Island steelhead count was 2,400; in 1944 it was 1,329, and in 1950 there were 1,840 counted at the dam. The years in between show wide fluctuations.

Thus it would appear that the Grand Coulee fish maintenance project is an outstanding, successful experiment in salvaging salmon runs. The "home streams" of thousands of commercially valuable salmon and trout were changed. The analysis of the data in the accompanying table clearly indicate that the ratio of Rock Island counts to the comparable Bonneville count is favorable for blueback salmon. The chinook salmon have more than "held their own" with some fluctuation in abundance. THE END.

Reclamation Aids Fish and Wildlife

"More and more, all over the West, people are finding that in actual practice, fish and wildlife improvement is prominent among the positive benefits of the Reclamation program."

This is an excerpt from Reclamation Commissioner Michael W. Straus' official policy statement read by planning engineer Vand E. Larson at the conference of the Western Association of Game and Fish Commissioners held in Phoenix, Ariz., on April 30, 1951.

The statement urged positive action for the development of the Nation's fish and wildlife resources, pointing out that provisions for preservation of fish and wildlife on Reclamation projects had been a fundamental Bureau policy for more than 49 years, and that methods of protection were incorporated in project plans after consultation with conservationists. In his statement, Commissioner Straus asserted, "There need be no conflict between common-sense irrigation and fish and wildlife development if both will plan and both will work on the basis of the greatest good for the greatest number. Reclamation has supported and does support fish and wildlife development. State organizations and local irrigation districts, I believe, should do likewise. But the way to do this when water development is involved is not to fight to hold back Reclamation proposals but to push forward fish and wildlife proposals." ●

Short Cuts to Weed Killing Calculations

Part 6.—Preparing Weed-Killing Solutions with Liquid

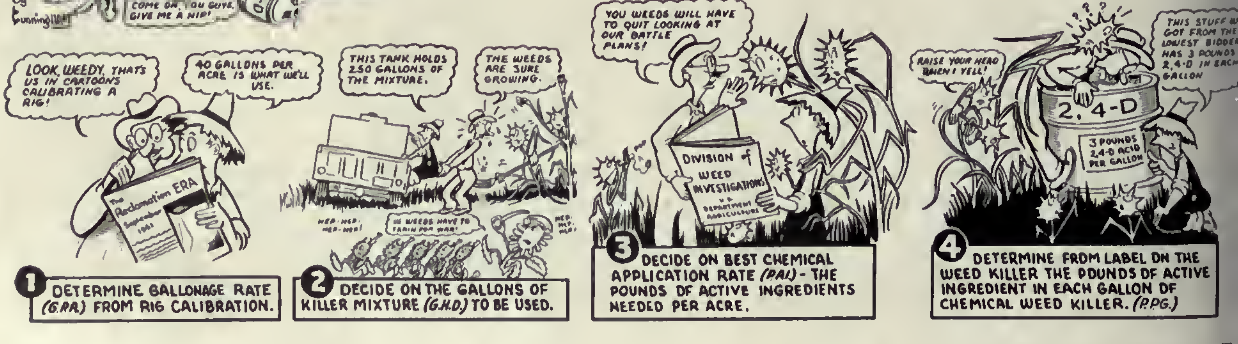
by JOHN T. MALETIC

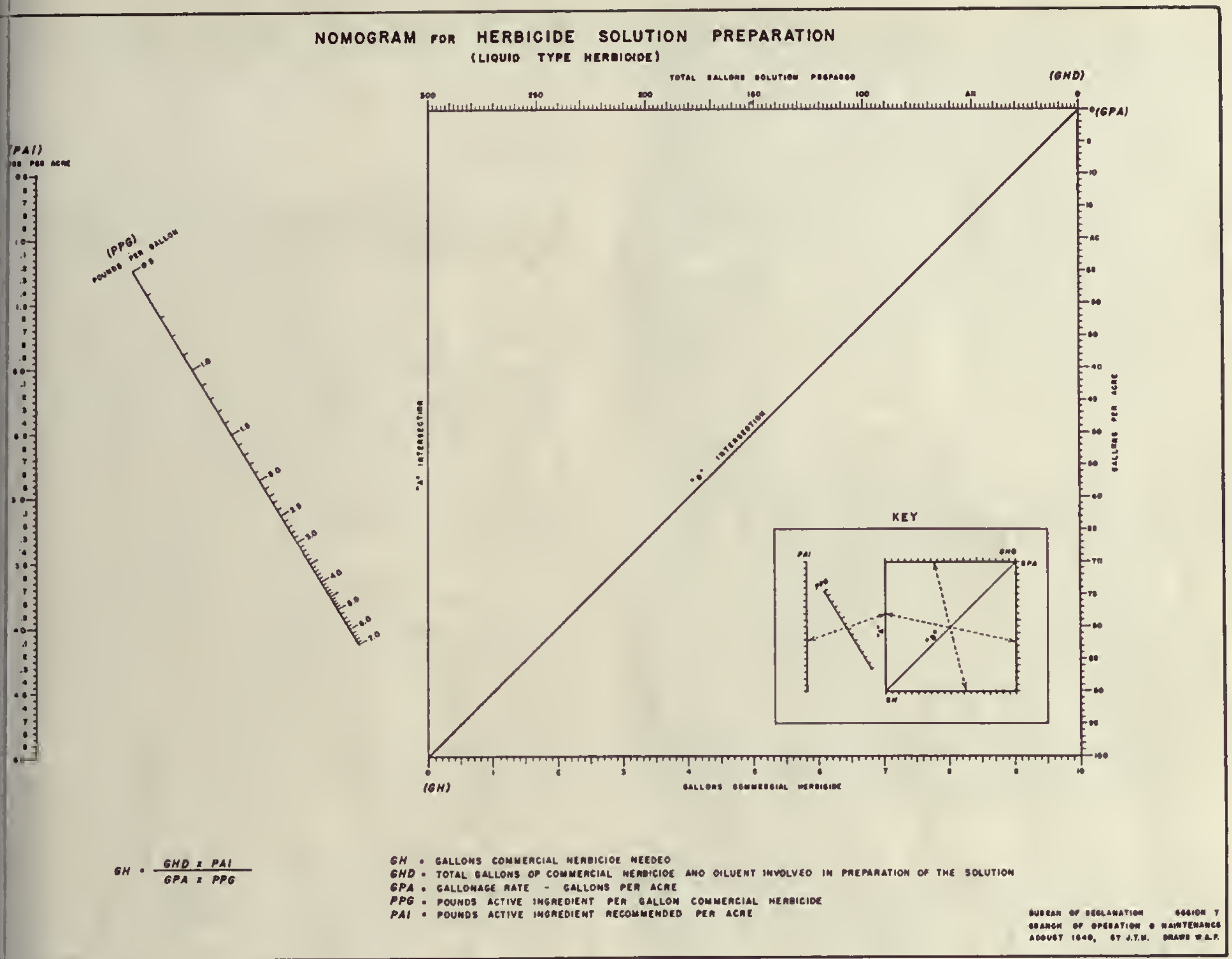
Soil Scientist and Weed Specialist
Region 7 headquarters, Denver, Colo.

YOU CAN SAVE MONEY fighting weeds by making several simple calculations. Suppose you want to put a specified amount of weed killer on an acre, how do you go about putting on the specified amount—no less and no more? First, you must calibrate the spray rig so that at a given speed the rig puts out the exact gallonage you want on each acre (see the September issue of the RECLAMATION ERA). Secondly, you mix the spray solution so that each gallon of the solution has just the right proportion of water and chemical. For example, suppose you wanted to put on 1 pound of 2,4-D acid on an acre of weeds. If the spray rig were calibrated to deliver 20 gallons per acre, then every 20 gallons in the spray tank would have to contain 1 pound of 2,4-D acid. If the weed killer you use contains inert ingredients and if it is in the liquid form, this must be taken into account when figuring the proportion of water and chemical to use. The nomogram on the opposite page will do the calculating for you—here then are the simple steps in preparing a spra solution with a liquid weed killer:

(1) Determine the number of gallons you wa to put on each acre—this is the "gallonage rat on the GPA scale, and should be determined wh the rig is calibrated; (2) Decide upon the tot gallons of spray solution (on GHD scale) you ne this should be noted by marking the level of t tank or using a dip stick with a marker; (3) D cide on the best chemical application rate—th is, the pounds of active ingredient in the we killer needed per acre—this is on the PAI scal (4) From the label on the weed killer, read off t pounds of active ingredients in each gallon f the PPG scale. Knowing these four values, fi the gallons of weed killer chemical needed by (connecting pounds per acre (PAI) with poun per gallon (PPG) using a transparent straig edge and marking the point at which the straig edge crosses the "A" intersection; (b) connect t "A" intersection with the gallons per acre (GP and find a point on the "B" intersection; (finally connect the intersection point of "B" wi total gallons of solution being prepared (GHI Read the answer on the gallons commercial herb cide (GH) scale. This manner of connecting t scale is shown in the key in the diagram.

For example, a weed killer containing 3 poun of active ingredients per gallon is to be appli at the rate of 2 pounds per acre by a spray r calibrated to deliver 40 gallons per acre. If 2 gallons of solution are needed, how many gallo of weed killer should be placed in the tank? Co



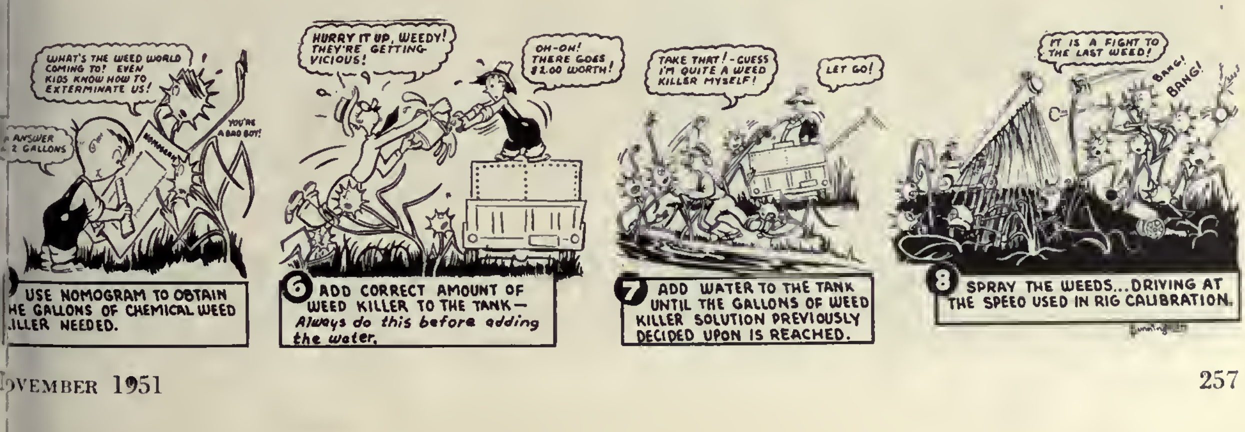


...t 3 on PPG (pounds per gallon) with 2 on ...AI (pounds per acre); connect "A" intersection ...th 40 on GPA (gallons per acre); connect B ...ersection with 250 on GHD (gallons solution) ...d you have your answer—4.2 gallons on GH ...allons herbicide).

...Now, add the 4.2 gallons of weed killer to the ...k first, then fill with water until you have 250 ...llons of solution. The weed killer is now prepared, but to make sure that the right amount is applied to each acre, drive the spray rig at the speed for which it was calibrated.

NEXT MONTH: Part 7—How to Prepare Weed Killers for Woody Plants.

Reprints of this series are available upon request of the Commissioner or your nearest Regional Director. See inside back cover of this issue for addresses.



NEW CHECK for FARM DITCHES

by MARVIN N. SHEARER, County Extension Ag
(Soils and Irrigation), Oregon State College, Madr
Oreg., United States Department of Agriculture a
Jefferson County cooperating.

ON SOME IRRIGATION FARMS, permanent che structures are necessary and desirable. They ho back the flow of the water for proper applicati at the right place and time, they prevent erosi make possible the irrigation of sloping lands a have many other advantages.

But when the time comes to clean weeds a silt and debris out of the ditches, these bulkhe become bug-a-boos, nuisances and obstructio The only way to do the job properly is by han a messy, tedious and tiresome undertaking. I things are different out at the Jay Macy farm the North Unit of the Deschutes project in Jeff son County, Oreg. This year Macy has perman check structures and an easy cleaning job, too. a matter of fact, the cleaning equipment can p right through the checks without injuring th

The secret lies in the removable panel wh houses the check boards. This small redwood d can be lifted easily out of its base making it p sible to remove the entire obstruction from w to wall. Once it is out of the way a chattin similar type ditcher can run through the ch and the entire length of ditch to be cleaned.

The concrete structure which holds the pa in place is basically a reinforced concrete di lining 4 inches thick and 4 feet long, with a he wall, containing bolts for holding the panel place, and tailor-made grooves to insure a perf fit. The bolts in the concrete work must be pla so they will not damage tractor tires during cle ing operations. As shown in figure 5, the perm nent portion of this check takes the shape of

BUILDING THE BASIN. Fig. 1, cut an 8" headwall into the b place the form in position and cut ditch bank back 4" to pro bed for concrete. Fig. 2, dump concrete into ditch form to headwall. Fig. 3, work the form into position. Fig. 4, us shovel and trowel to shape the sidewalls of the basin.

ch itself, and is reinforced with welded wire sh. The minimum recommended width of the sin floor is 18 inches for ditches carrying $1\frac{1}{2}$ ond-feet of water, and 24 inches for ditches rying up to 3 second-feet of water. The slop- sides make the check "ride the ground" during ezing winter temperatures. They lift the en- structure when the ground heaves and lower it en it thaws.

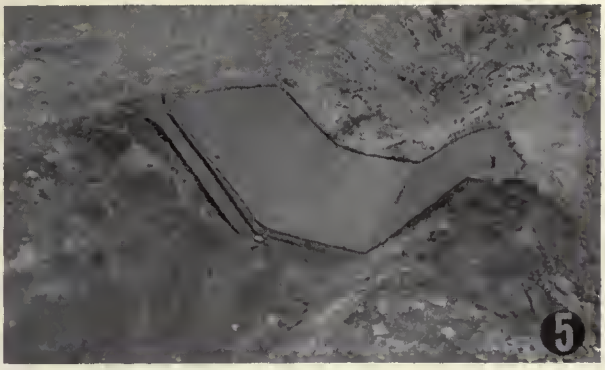
The panel is made of 1-inch redwood, put to- her as shown in figure 6. The check guide rds are bolted or nailed with galvanized nails the panel walls, thus serving a dual purpose of ding the panel together and furnishing grooves inserting the check boards as demonstrated in ure 7. As can be seen in these photos, the square ening in the panel is no wider than the bottom the stilling basin. This is necessary to keep to inimum any turbulence around the lower side the structure.

The Jefferson County Extension Office devel- ed plans for this check during the past 2 years, l when Jay Macy was in our office this spring became so interested he immediately installed of them. This is how much the job cost for terial and labor:

man-hours at \$1.25 per hour	\$3.13
sacks cement at \$1.35 per sack	2.03
5 cubic yard sand at \$5 a cubic yard	.75
) cubic yard gravel at \$5 a cubic yard	1.00
oard feet redwood at \$125 per M	.88
rdware	.25
Total cost of check	8.04

After making a set of 3 forms, Macy's crew of 2 n installed one check every 45 minutes. The ncrete was allowed to set $1\frac{1}{2}$ hours, then the ms were removed and reused.

After using his checks for 2 months, Macy had s to say about them, "The initial cost of these uctures is not materially more than the tempo- y wooden ones previously installed. What is re, I am not bothered with mice damage, wash- ts, and leaks. This is as good a structure as I ve ever checked water with in my 20 years of igation farming. The feature of being able to ll a ditcher thru the structure when I clean eds and silt from my ditch has really made ditch aning a pleasure." The End.



TING IN THE PANEL. Fig. 5, the permanent concrete base uld look like this when finished. Fig. 6, lower the panel into groove provided in the concrete. Fig. 7, adjust the check rds in the grooves of the check guide boards, at whatever ght you need. Fig. 8, the finished check in operation.

WATER REPORT

(Continued from page 251)

per Colorado River watershed water supplies were adequate. There was some shortage on the Arkansas and Gunnison River watersheds. An extreme deficiency in water supply existed on the Rio Grande and San Juan Rivers. On these latter watersheds, the general water supply was as little as at any time in recent irrigation history. This was due to the extreme shortage of snow cover during last winter and also in lesser part to the lack of precipitation during the irrigation season.

The summer flow of the Colorado River and all of its tributaries in Colorado was somewhat less than was indicated by the snow cover last spring. This was due largely to an extreme deficiency in precipitation in mountain areas during the late fall and early winter months of 1950. Water supply was adequate on the upper Colorado, White, and Yampa Rivers and on projects served by the upper Gunnison River. On the lower Gunnison River near Delta and Grand Junction there was a shortage of late irrigation water.

On the Rio Grande main stem, there was an extreme water shortage which was temporarily and partially alleviated by an increase in the amount of pumping. On some of the tributary streams to the east of the Valley, crop curtailment was almost complete. In this area, there is little opportunity for groundwater development. The water supply ranged from 10 to 25 percent of normal.

Gaging station	Obtained [1] acre-feet	Forecast for April–September			
		Apr. 1		May 1	
		Acre-feet	Error, percent	Acre-feet	Error, percent
Rio Grande at Del Norte	254,000	325,000	28	325,000	28
Conejos at Mogote	107,000	140,000	31	150,000	40
Animas at Durango	263,000	325,000	24	325,000	24
Roaring Fork at Glenwood Springs	750,000	950,000	27	900,000	20
Uncompahgre at Colona	71,000	125,000	76	125,000	76
Gunnison at Iola	777,000	700,000	10	700,000	10
Colorado near Grand Canyon	7,100,000	9,200,000	30	9,200,000	30
Poudre at Canyon	301,000	275,000	9	300,000	0

[1] Preliminary only, subject to revision.

IDAHO.—In general, the forecasts from snow water were for the above normal run-off which occurred on all major rivers. Heavy fall precipitation in Idaho during 1950 had a significant effect on the flow of the rivers in the spring of 1951. The soil was well primed on all rivers for the production of run-off from the normal or better snow cover. However, the unusual pattern of spring precipitation had its effect on flows because it was well above average on some streams and well below on others. Precipitation on the Kootenai River watershed was almost 3 inches above average for the period April through June, while that on the Clearwater was almost 2 inches below.

This year early precipitation over most of Idaho has been well below normal. This deficiency, if continued through October, will diminish the snow water yield for 1952. If snowfall during the coming winter is also below normal, run-off for 1952 will undoubtedly be well below that of the past 5 years.

Gaging station	Obtained [1] acre-feet	Forecast for April–September			
		Apr. 1		May 1	
		Acre-feet	Error, percent	Acre-feet	Error, percent
Kootenai at Leonia	10,813,000	10,000,000	8	9,200,000	15
Clearwater at Spaulding	8,310,000	8,800,000	6	8,800,000	6
Boise above Diversion	1,992,000	1,800,000	10	1,800,000	10
Salmon at Whitebird	7,726,000	9,000,000	16	8,000,000	4

[1] Preliminary only, subject to revision.

MONTANA.—The irrigation water supply for 1951 w adequate until early August. Due to below average p cipitation during the summer months, the water supp dropped sharply during August and some shortages we then noted in areas lacking reservoir storage.

Gaging station	Obtained [1] acre-feet	Forecast May–September			
		Apr. 1		May 1	
		Acre-feet	Error, percent	Acre-feet	Err perc
Judith River near Utica	39,900	30.580	23	30,580	
Yellowstone River at Corwin Springs	2,159,000	1,770,000	18	1,770,000	
Flathead River at Columbia Falls	7,224,000	7,200,000	0	7,200,000	

[1] Preliminary only, subject to revision.

NEVADA.—The 1951 forecast for irrigation season stre flow varied from drought conditions in central and sou ern Nevada to about 50 percent above normal in the no on the main Humboldt. Snowmelt run-off from the ea ern Sierra-Nevada was forecast from 25 to 50 percent normal. Preliminary stream flow measurements indic the Humboldt forecasts were high and the Sierra fo casts were low. The drought in central and south Nevada continues unabated. Climatological data at representative stations in the Upper Humboldt Ba show that during April, May, and June, average tempe ture was about 3 degrees below normal. This had retarding effect on the melting of snow at high elevatio In fact, snow is still stored in drifts at high elevati and will probably remain there until next run-off seas It appears that the error in the Sierra forecasts is due giving insufficient weight to the 350 percent normal p cipitation which occurred during the storms of l November and December.

Gaging station	Obtained [1] acre-feet	Forecast for April–J	
		Apr. 1	
		Acre-feet	Error, cent
Humboldt River at Palisade	189,660	300,000	
West Walker near Coleville	141,950	100,000	

[1] Preliminary only, subject to revision.

NEW MEXICO.—The irrigation water supply in N Mexico this year was probably the poorest of rec Flow of the Rio Grande and its tributaries ranged fr 5 to 20 percent of normal. Precipitation has been d cient for the past 2 or more years. Very little stora water was available and this was exhausted early in season. Unless the snow accumulation during the 19 52 season is well above normal over the whole Rio Gran watershed, another year of water shortage may expected.

Gaging station	Obtained [1] acre-feet	Forecast for April–September			
		Apr. 1		May 1	
		Acre-feet	Error, percent	Acre-feet	Er pe ce
Rio Grande at Otowi Bridge	190,000	175,000	8	225,000	
Rio Grande at San Marcial	50,000	50,000	0	75,000	

[1] Preliminary only, subject to revision.

OREGON.—Oregon precipitation during April–Septem fell far below average. Exact figures are not availab but indications are that the drought was relatively m severe west of the Cascade Mountains. Practically provisional data of stream flow are available as of t date, but it is believed that smaller flows were obtai than were forecast. This was due to the summer droug In general, the watersheds of highest elevations and g snow pack provided sufficient water supplies. M smaller drainages with low watersheds showed ea shortages of water for irrigation.

Gaging station	Obtained[1] acre-feet	Forecast for April–September			
		Apr. 1		May 1	
		Acre-feet	Error, percent	Acre-feet	Error, percent
...er Klamath Lake in-...w	588,500	370,000	37	540,000	8

...reliminary only, subject to revision.

...OUTH DAKOTA.—The irrigation water supply in the ...ck Hills area of South Dakota was below normal for ...s past year. Soil moisture and crop conditions are ...y reported as good due to precipitation during the late ...mmer and fall.

...TAH.—The April 1 forecast was for water supply vary-... from excellent on the Cache and Wasatch forests in ...thern Utah to poor in Eastern Utah on Ashley Creek ...l severe drought in southern Utah. Although this gen-...l run-off pattern followed, above average April–May ...cipitation was responsible for stream flow greater ...n indicated in the forecast.

...n southern Utah on Beaver River, the Beaver City ...cipitation station reports 180 percent of normal pre-...itation for the April–May period, accounting for the ...ra run-off here. In general throughout southern ...ah, observers report that although more springs have ...ed up this year than usual, fall rains have left the ...face soils of both watersheds and cropped lands in an ...rage or better condition, preparatory for the coming ...w accumulation season.

Gaging station	Obtained[1] acre-feet	Forecast for April–September	
		Apr. 1	
		Acre-feet	Error, percent
... River at Harer, Idaho	408,000	295,000	28
Cottonwood Creek near S. L. C.	41,100	39,000	5
...ksmith Fork near Hyrum	92,900	67,500	37
...le Bear River near Paradise	51,800	45,000	13
...h Fork Ogden River near Hunts-...lle	94,900	77,000	19
...ver River near Oakley	147,800	145,000	2
...ley Creek near Vernal	48,600	42,000	14
...hesne River near Tabiona	140,800	118,000	16
...tington Creek near Huntington	56,600	40,000	29
...ver River near Beaver	18,100	13,500	25
...er River at Hatch	22,700	22,000	3

...reliminary only, subject to revision.

...VASHINGTON.—Relatively high flow of the major rivers ...Washington as forecast from snow data occurred with ...y little change due to spring precipitation departures. ...Snow water stored in 1951 at high elevation was pro-...tionately greater in relation to low level snow cover ...an normal. This condition resulted in sustained flows ...the Columbia River and many tributaries. Fall pre-...itation in Washington during 1950 was well above ...rmal, which also may have helped to sustain the flow ...the rivers.

...VYOMING.—Irrigation water supply for the State of ...oming was generally adequate for the 1951 season. ...scharge of the North Platte, Laramie, and Green Rivers ...s above normal.

...In general, that portion of Wyoming contributing to ... flow of the Snake River produced greater than aver-...e stream flow. Some damage occurred along the Snake ...ver in Wyoming as a result of the snow-melt flood ...ich was partially controlled by dikes and regulation ... water in Jackson Lake.

Gaging station	Obtained[1] acre-feet	Forecast for April–September			
		Apr. 1		May 1	
		Acre-feet	Error, percent	Acre-feet	Error, percent
...rth Platte at Saratoga	756,000	725,000	4	750,000	1

...Preliminary only, subject to revision.

Shadehill Dam Completed in Record Time

Secretary of the Interior Oscar L. Chapman on September 6 announced the completion of construction on the Shadehill Dam in South Dakota in 85 percent of the initial time allotted for this work.

Shadehill Dam is a key feature of the Grand Division of the Missouri River Basin project and will provide irrigation water for 9,000 acres in Perkins and Corson Counties, S. Dak. It will also provide flood and silt control for the Grand River and materially reduce the amount of silt being carried into the Oahe Reservoir on the Missouri River.

The rolled earth-fill structure consists of the main dam, approximately 1,800 feet long and 120 feet high and a dyke which is 11,000 feet long and 30 feet high. The total volume of both is 3,500,000 cubic yards.

It is hoped to have the entire development completed to permit irrigation by 1954. •

Delegates Meet for 20th Annual NRA Convention at Amarillo, Texas

At the 20th Annual National Reclamation Association Convention held at Amarillo, Tex., October 17–19, 1951, the delegates passed a total of 38 resolutions, reaffirming opposition to Valley authorities, and supporting coordinated basin-wide planning and development. The Association favored continued construction of projects "necessary to keep the nation economically strong and adequately to serve the increasing demands and requirements of national defense," also urging that priority be given to power development for irrigation pumping.

Officers elected for the coming year included C. Petrus Peterson of Lincoln, Nebr., president: Charles L. Kaupke of Fresno, Calif., 1st vice president; State Senator Earl T. Bower of Warland, Wyo., 2nd vice president; and Herbert L. Buck of Billings, Mont., treasurer. In addition, Fred Wilson of New Mexico and LaSalle Coles of Oregon were elected to serve with these officials on an Executive Committee.

Retiring NRA President Harry E. Polk presided over the meetings, which included an important address by Congresswoman Reva Beck Bosone of Utah, entitled "Small Projects Bring Big Problems," a speech by Wyoming's Governor Frank A. Barrett on the nation's need for western reclamation, Commissioner of Reclamation Michael W. Straus' talk on the future of reclamation, and many other significant discussions.

In conjunction with, and prior to the NRA meeting, the Association of Western State Engineers held their annual meeting in Amarillo. •

Water Stored in Reclamation Reservoirs

Location	Project	Reservoir	Storage (in acre-feet) Active capacity [1]	Sept. 30, 1950	Sept. 30, 19
Region 1	Baker	Thief Valley	17, 400	600	2, 5
	Bitterroot	Lake Como	34, 700	12, 600	7, 6
	Boise	Anderson Ranch	464, 200	266, 900	344, 6
		Arrowrock	286, 600	10, 000	36, 1
		Deadwood	161, 900	127, 000	
		Lake Lowell	169, 000	38, 900	53, 2
	Burnt River	Unity	24, 600	5, 200	2, 6
	Columbia Basin	F. D. Roosevelt	5, 220, 000	5, 200, 000	5, 220, 0
	Deschutes	Crane Prairie	50, 000	34, 700	57, 0
		Wickiup	182, 000	28, 300	19, 0
	Minidoka	American Falls	1, 700, 000	923, 600	1, 021, 3
		Jackson Lake	847, 000	568, 500	622, 7
		Lake Walcott	95, 200	93, 300	94, 0
		Grassy Lake	15, 200	12, 200	12, 1
		Island Park	127, 300	87, 900	86, 4
	Okanogan	Conconnully	13, 000	3, 600	7, 5
		Salmon Lake	10, 500	10, 100	10, 2
	Owyhee	Owyhee	715, 000	350, 100	390, 7
	Umatilla	Cold Springs	50, 000	6, 100	4
		McKay	73, 800	22, 300	13, 8
	Vale	Agency Valley	60, 000	0	3, 0
		Warm Springs	191, 000	0	5, 0
	Yakima	Bumping Lake	33, 800	4, 600	3, 0
		Cle Elum	435, 700	229, 700	159, 5
		Kachess	239, 000	129, 800	123, 8
		Keechelus	153, 000	86, 800	55, 0
		Tieton	197, 000	112, 400	80, 6
Region 2	Central Valley	Millerton Lake	500, 000	57, 100	125, 1
		Shasta	4, 366, 800	2, 702, 000	2, 431, 4
	Klamath	Clear Lake	513, 300	87, 900	66, 7
		Gerber	94, 300	10, 200	18, 2
		Upper Klamath Lake	524, 800	266, 000	214, 4
	Orland	East Park	50, 600	10, 100	10, 2
		Stony Gorge	50, 000	6, 600	3, 8
Region 3	Boulder Canyon	Lake Mead	27, 207, 000	19, 751, 000	19, 118, 0
	Parker	Havasu	688, 000	586, 600	600, 9
	Salt River	Bartlett	179, 500	2, 900	25, 0
		Horse Mesa	245, 100	200, 800	62, 0
		Horseshoe	144, 000	800	7, 0
		Mormon Flat	57, 900	52, 200	18, 0
		Roosevelt	1, 381, 600	5, 200	87, 0
		Stewart Mountain	69, 800	45, 600	38, 0
Region 4	Fruit Growers	Fruit Growers	4, 500	700	3
	Humbolt	Rye Patch	179, 000	28, 900	85, 3
	Hyrum	Hyrum	15, 300	6, 900	5, 6
	Moon Lake	Moon Lake	35, 800	10, 900	11, 9
	Newlands	Lahontan	290, 900	159, 800	110, 0
		Lake Tahoe	732, 000	332, 400	531, 6
	Newton	Newton	5, 300	1, 100	1, 5
	Ogden River	Pine View	44, 200	15, 600	13, 4
	Pine River	Vallecito	126, 300	24, 800	22, 4
	Provo River	Deer Creek	149, 700	123, 300	117, 7
	Scofield	Scofield	65, 800	26, 900	26, 7
	Strawberry Valley	Strawberry	270, 000	123, 800	132, 7
	Truckee River Storage	Boca	40, 900	27, 700	27, 8
	Uncompahgre	Taylor Park	106, 200	35, 200	45, 5
	Weber River	Echo	73, 900	39, 500	38, 4
Region 5	W. C. Austin	Altus	145, 000	148, 900	100, 6
	Balmorhea	Lower Parks	6, 000	3, 000	1
	Carlsbad	Alamogordo	131, 900	95, 200	13, 2
		Avalon	6, 600	5, 500	6, 6
	Rio Grande	Caballo	345, 900	43, 100	9, 6
		Elephant Butte	2, 197, 600	333, 400	19, 4
	Tucumcari	Conchas	269, 100	214, 000	135, 3
Region 6	Belle Fourche	Belle Fourche	185, 200	47, 900	44, 0
	Milk River	Fresno	127, 200	34, 100	94, 9
		Nelson	68, 800	19, 000	42, 5
		Sherburne Lakes	66, 100	22, 000	15, 6
	Riverton	Bull Lake	155, 000	101, 300	146, 6
		Pilot Butte	31, 500	6, 200	4, 2
	Shoshone	Buffalo Bill	394, 600	391, 300	389, 7
	Sun River	Gibson	105, 000	63, 500	70, 1
		Pishkun	30, 100	23, 800	24, 3
		Willow Creek	32, 400	21, 200	23, 6
Region 7	Colorado-Big Thompson	Green Mountain	146, 900	119, 400	132, 3
	Kendrick	Alcova	190, 300	173, 000	162, 8
		Seminoe	993, 200	713, 000	908, 3
	Mirage Flats	Box Butte	30, 600	10, 300	17, 9
	North Platte	Guernsey	44, 200	16, 900	
		Lake Alice	11, 000	2, 400	3,
		Lake Minatare	60, 800	13, 900	21,
		Pathfinder	1, 040, 500	587, 800	371,

[1] Available for irrigation.

CROPS

rop Values Hit All-Time High

relimlnary estimates of more than nillion tons for crops produced on lamation projects as published in July issue, page 155, prove to be rly modest now that the final returns in.

ctually more than 16,083,000 tous of l and forage were produced on 5,- 000 acres of land irrigated by Rec- ation facilities on 62 projects. The vious record volume for crop pro- tion was scored in 1946 with a 14,- 000-ton production.

s to total value, 1950 set another ord at $578,238,000 or 23 million dol- greater than the previous high of 7's $555 million. Last year marked fifth consecutive year that Reclama- crops were valued at more than f a billion dollars.

he total production was 2.8 million s of hay and forage; 4.3 million tons vegetables and truck; 4 million tons sugar beets, and 1.4 million tons of its and nuts. Per-acre crop value nbed from an average of $105.03 in 9 to $111.43 in 1950, the sixth straight r of crop value over $100 per acre.

Estimates based on both crop tonnage l acres irrigated indicate that from to 300 million tons of fruits and etables, cotton, sugar beets, and feed l forage have been produced on Rec- nation watered lands since the initial ter delivery in 1906. The value of se crops served in whole or in part Reclamation facilities since 1906 is at 7.1 billion dollars.

Bureau built facilities were extended provide service for additional acreage 22 projects in the West in 1950, the eatest increase being on the Central lley project in California where 2,000 acres were provided with sup- emental water for the first time dur- g the year. ●

LETTERS

Testimonials

Our mail box last month carried exceptionally large number of ngratulatory comments, from which we select a few typical ex- cerpts:

FROM COMPRESSED AIR MAGAZINE, Phillipsburg, N. J., Jack C. Pierce, as- sistant editor, said, "Your September 1951 issue of the RECLAMATION ERA is customarily fine but unusually interest- ing to us. Water and the World, Fly Ash Saves Money and Strengthens Can- yon Ferry, and Roof Bolts for Duchesne, all struck our fields of interest, but Gassing the Gophers by Hu Blonk stands out as a unique application of compressed air."

FROM SAN LEANDRO, CALIF., Sam Mitu- yosi writes, "The new RECLAMATION ERA is very interesting. May I sub- scribe?"

FROM HILO, HAWAII, Ellwood Lewis Bartz writes, "The RECLAMATION ERA is an excellent publication in its field . . . I am a Hydraulic Engineer with the Territorial Department of Public Works and am at present working on the de- velopment of an irrigation and water utilization project on this island . . . My problem in general is to investigate the rainfall and runoff in a specified area and then locate and design storage facilities and distribution systems for the use of this water on tillable lands which presently are unused because of lack of adequate water supply. Mehalo nui and aloha from Hawaii Nei (which translated means, "many thanks and best wishes from greater Hawaii")."

FROM FAIRHOPE, ALA., Robert C. Keeney writes, "This (meaning the REC- LAMATION ERA) is one of the best in- formative publications I know for the price, and it's more interesting to me as I am somewhat familiar with western irrigation and we are starting to use it here in this county a little more each year."

We are not bragging. We just want our contributors to know how much their work is appre- ciated by our subscribers.

OUR BACK COVER is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners, Kittredge and Coolidge.

RELEASES

Reclamation Handbooks Help Japan

According to a press statement from the Natural Resources Section of the Japanese Government, a recent arrival of a shipment of engineering handbooks, obtained by arrangement with and the cooperation of the United States Bu- reau of Reclamation was exceptionally timely in view of the large number of river utilization projects now being con- sidered by the various Japanese agen- cies.

Selected portions of the handbooks are to be translated into Japanese. ●

New Yakima Project Folder Available

A new illustrated folder on the Bu- reau's Yakima project, located in the central part of Washington State is now available to the public.

There is no charge for this folder. Copies may be obtained by writing to the Regional Director, Bureau of Recla- mation, Box 937, Reclamation Build- ing, Fairgrounds, Boise, Idaho. ●

New Maps Available

The Drafting Section of the Bureau of Reclamation has recently completed the following project maps: Grand Valley project, Colo.; Humboldt project, Nev.; Frenchman-Cambridge Division, Mis- souri River Basin project, Nebr.; Lower Marias Unit, Lower Marias Division, Missouri River Basin project, Mont.; Yellowstone Division, Missouri River Basin project, Mont.; and Uncompahgre project, Colo.

These maps are available in both the small (10½ by 17) and large (21 by 34) sizes. The maps are all in color and re- quests should be sent to the nearest regional director (see directory on in- side back cover of this issue), specify- ing the name and size of the maps desired. Single copies are available free to those who need them in connec- tion with their work or studies. ●

Through an unfortunate oversight, the photos appearing on page 221 of the October 1951 issue, illustrating the article entitled, "Fort Sumner Forti- fied," did not carry the names of the Region 5 photographers. Fred Finch took the photo of the dam, and William N. Roth photographed the canal.

NOTES FOR CONTRACTORS

Contracts Awarded During September 1951

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DS-3350	Davis Dam, Ariz.-Nev	Sept. 10	Radio communication equipment, including 25 mobile radio transmitter-receiver assemblies.	Link Radio Corp., New York, N. Y.	$36,
DC-3413	do	Sept. 4	Completion of Davis Dam spillway stilling basin and excavation for Colorado River channel improvement.	Grafe-Callaban Construction Co., Dallas, Tex.	2,731,
DC-3457	Columbia Basin, Wash	Sept. 20	Painting steel liners of 102-inch outlet works conduits in spillway section of Grand Coulee Dam.	Wiscombe Painting and Decorating Co., Salt Lake City, Utab.	87,
DS-3465	Colorado-Big Tbompson, Colo.	Sept. 14	1 station-service power distribution board for Pole Hill power plant, schedule 1.	Wolfe and Mann Mfg. Co., Baltimore, Md.	12,
DS-3476	do	Sept. 26	1 controlling and two controlled statiou supervisory control and telemetering switchboard cubicles and equipment and 1 lot of carrier-current equipment for Granby pumping plant and Willow Creek Dam and pumping plant.	Control Corp., Minneapolis, Minn.	31,
DS-3478	Columbia Basin, Wash	Sept. 27	8 replacement bushings for power circuit breakers for Grand Coulee 230-kilovolt right switcbyard.	General Electric Co., Denver,	44,
DS-3491	Kendrick, Wyo	Sept. 14	2 16,500/22,000 kilovolt-ampere transformers with 3 lightning arresters for Alcova switchyard, schedule 1.	Westinghouse Electric Corp., Denver, Colo.	149,
Do	do	do	3 115,000-volt circuit breakers for Alcova switchyard, schedule 2	Pacific Electric Manufacturing Corp., San Franeiseo, Calif.	72,
DS-3497	Missouri River Basin, Wyo	Sept. 21	1 control board, 2 carrier-current relaying transmitter-receiver sets, and 1 set of line protective and carrier-current relays for Lovell and Thermopolis substations.	General Electric Co., Denver, Colo.	23,
DC-3500	Cachuma, Calif	Sept. 11	Construction of concrete-lined Sheffield tunnel, Carpinteria section, South Coast conduit.	A. J. Cheff Construction Co., Seattle, Wasb.	855,
DC-3501	Kendrick, Wyo	Sept. 13	Construction of 36 miles of Seminoe-Bairoil 34.5-kilovolt transmission line.	L and S Construction Co., Casper, Wyo.	64,
DC-3502	Central Valley, Calif	do	Construction of Tracy switchyard 115 and 69-kilovolts switchyard additions.	Del Monte Electric Co., Oakland, Calif.	150,
DC-3503	Colorado-Big Thompson, Colo.	Sept. 18	Construction of Rattlesnake Dam, Estes Park-Foothills power aqueduct.	Adler Construction Co., Loveland, Colo.	825,
DS-3504	Central Valley, Calif	Sept. 20	1 lot of distribution piping and appurtenances for Trauger pumping plant, Lindsay-Stratbmore irrigation district, Friant-Kern canal distribution systems.	Southwest Welding & Manufacturing Co., Alhambra, Calif.	84,
DS-3505	Missouri River Basin, S. Dak.	Sept. 5	10 potential and 3 current transformers for Huron, Mount Vernon, Watertown, and Sioux Falls substations.	Gough Industries, Inc., Los Angeles, Calif.	21,
DS-3507	Colorado-Big Thompson, Colo.	Sept. 24	1 76-inch butterfly valve for Flatiron power and pumping plant, item 1.	Guy F. Atkinson Co. d. b. a. Willamette Iron and Steel Co., Portland, Oreg.	58,
DC-3510	Middle Rio Grande, N. M	Sept. 25	Construction of channelization of the Rio Grande River from San Marcial to the narrows of Elephant Butte reservoir.	McGinnes Bros., Inc., Houston, Tex.	940,
DC-3515, DC-3516, DC-3517	Missouri River and Basin, S. Dak.	Sept. 24	Construction of Winner, Bonesteel, and Gregory substations	C-L Electric Co., Pocatello, Idaho.	109,
DC-3523	Eklutna, Alaska	Sept. 17	Construction of Eklutna tunnel, schedule 1	Palmer Constructors (Consisting of Peter Kiewit Sons' Co. Coker Construction Co. and Morrison-Knudsen Co., Inc.) Omaha, Nebr.	17,348,
117C-113	Columbia Basin, Wash	Sept. 20	Watermaster office building, service buildings and permanent residences for O & M Headquarters at Eltopia, Wash.	Westover & Hope, Quincy, Wash.	169,
601C-17	Missouri River Basin, Wyo	Sept. 6	Exploratory drilling for Raft Lake Du Noir, Red Bluff, North Fork and Soral Creek dam sites.	Boyles Bros. Drilling Co., Salt Lake City, Utah.	27,
704C-178	Colorado-Big Thompson, Colo.	Sept. 7	Construction of garage and shop buildings at Brighton, Beaver Creek, Sterling, and Yuma substations.	John A. Bell, Berthoud, Colo.	21,
703C-214	Missouri River Basin, Wyo	Sept. 18	Seminol-Kortes control cable line	American Electric Co., Caldwell, Idabo.	35,
704S-199	Colorado-Big Thompson, Colo.	Sept. 5	Electrical equipment for Gunnison and Salida substations, schedule 1.	Pennsylvania Transformer Co., Cannonsburg, Pa.	70
704S-199	do	Sept. 6	Electrical equipment for Gunnison and Salida substations, schedules 3, 5, 10, 11, 12, 13, and 14.	Westinghouse Electric Corp., Denver, Colo.	34,

Construction and Materials for Which Bids Will Be Requested by January 1952

Project	Description of work or material
W. C. Austin, Okla	Construction of 8 miles of drains and drainage structures and placing asphalt membrane lining on 0.5 mile of 400 cubic feet per second capacity Altus canal, near Altus, Okla.
Boulder Canyon, Ariz.-Calif.	Construction of 5.4 miles of 12- to 42-inch diameter concrete pipelines for unit 9, part II of the Coachella Valley distribution system, near Coachella, Calif.
Cachuma, Calif	Construction of Lauro chlorination and control house, an 18- by 65-foot concrete building near Santa Barbara Calif.
Do	Construction of 16 miles of concrete pipe conduit, varying in size from 36- to 27-inch diameter, and three control stations, part of the Carpinteria section of South Coast conduit near Santa Barbara, Calif.
Central Valley, Calif	Construction of 100,000-kilowatt Folsom power plant. This semi-outdoor type plant will require construction of a reinforced concrete structure about 120 by 240 feet and 107 feet high, and installation of three 74,000-horsepower turbines and a 300-ton gantry crane.
Central Valley, Calif	Constructing about 20 miles of 230-kilovolt steel-to transmission line between Elverta and Fols Calif.
Do	Fabricating and erecting safety cages for vert ladders for elevated water tank at Tracy pump plant.
Do	Construction of 43 miles of pipelines for Exeter ir tion district on the Friant-Kern canal distribut system, near Exeter, Calif. Contractor is to furn the 12- to 42-inch diameter pipe with heads up 75 feet.
Do	Three 4- by 19-foot and one 8- by 19-foot water scre with metalwork for Exeter Irrigation district N on the Friant-Kern canal distribution system.
Colorado-Big Thompson, Colo.	Installation of 40,000-kilovolt-ampere synchron condenser, 3 single-phase 16,000-kilovolt-amp transformers, one 300-kilovolt-ampere station serv transformer, and switching equipment; and erect steel structures for addition to 115-kilovolt Bea Creek substation near Brush, Colo.

Construction and Materials for Which Bids Will Be Requested by January 1952—Continued

Project	Description of work or material	Project	Description of work or material
...orado-Big Thompson, Colo.	Construction of 10 miles of 625- to 575-cubic feet per second capacity, partially lined St. Vrain supply canal, including a 50-cubic feet per second turnout feeding into the Little Thompson River, two 8.5-foot horseshoe shape tunnels, totaling 4,350 feet in length, and a 1,300-foot long 8.5-foot circular siphon, and other siphons, chutes, and spillways, near Lyons, Colo.	Davis Dam, Ariz.-Nev.	Erection of steel structures and installation of electrical equipment for the 69-kilovolt switchyard and transformer circuits at Davis Dam, Ariz.
...umbia Basin, Wash.	Painting metalwork at Grand Coulee Dam and right powerhouse, and 150,000 gallon water tank on right abutment at Coulee Dam.	Eklutna, Alaska	One 7.08- by 9-foot bulkhead gate with frame, anchors, and hydraulic hoist for Eklutna tunnel.
Do	Construction of 48 miles of unlined laterals and wasteways of 119- to 2-cubic feet per second capacity to irrigate about 18,000 acres in lateral area E-4 on the East Low Canal, 2 to 8 miles north of Warden, Wash.	Gila, Ariz	Construction of 28 miles of unreinforced concrete-lined Mohawk laterals and sublaterals of 120 to 15 cubic feet per second capacities, and appurtenant reinforced concrete structures, and removal of existing timber and concrete structures for unit 1, near Roll, Ariz.
Do	Construction of 20 miles of unlined laterals and wasteways of 180- to 2-cubic feet per second capacity to irrigate about 6,000 acres in lateral area P-3 on Potholes East Canal, 2 to 6 miles northwest of Mesa, Wash.	Kendrick, Wyo	Construction of 12 two-bedroom conventional-type wood-frame houses with full basement and attached garage near Alcova Dam, about 32 miles southwest of Casper, Wyo.
Do	Modification of Pasco relift pumping plant near Pasco, Wash.	Do	Construction of about 35 miles of double-circuit telephone line from new Casper substation to Alcova Dam.
Do	Drilling exploratory water supply well on part-time farm unit area near Soap Lake, Wash.	Middle Rio Grande, N. Mex.	Construction of 17 miles of Rio Grande River drainage and conveyance channel and levee from San Marcial, N. Mex., to channel headworks.
Do	Removing existing dike and constructing two new dikes in Trail Lake section of main canal about 6 miles south of Coulee City, Wash.	Missouri River Basin, Nebr.	One 30,000-kilovolt-ampere 3-phase synchronous condenser for Gering substation.
Do	Installation of miscellaneous equipment and machinery in operation and maintenance division headquarters shop at Quincy and Othello, Wash.	Missouri River Basin, Nebr.-S. Dak.	Installing Government-furnished armor-rods and vibration dampers and changing overhead ground wire connections on 98 miles of 115-kilovolt transmission line between Alliance and Chadron, Nebr., and between Fort Randall dam site, S. Dak., and O'Neill, Nebr.
Do	Construction of 21- by 13-foot permanent vault and 21- by 20-foot temporary storage room in Ephrata warehouse.	Missouri River Basin, Mont.	150,000 pounds of fabricated galvanized structural steel for bolted switchyard structures at Canyon Ferry power plant.
Do	Construction of 6 miles of 30-cubic feet per second capacity lined channel, 6 miles of 60-cubic feet per second capacity unlined channel, and 9 culverts for interception and conveyance of excess ground water in vicinity of Soap Lake, Wash.	Missouri River Basin, S. Dak.	Construction of 26,000-kilovolt-ampere Brookings substation.
Do	Construction of Lower Saddle Gap, Upper Saddle Gap, and PE-17 pumping plants and related laterals on Potholes East Canal. Work includes furnishing and erecting prefabricated steel buildings and constructing wasteways, 1,600 feet of lateral, and 20 miles of sublaterals in P1 and P13 lateral areas, 5 miles southwest of Othello, Wash.	Do	Construction of 7,500-kilovolt-ampere Summit substation.
Do	One horizontal-shaft, centrifugal-type pumping unit, 5 cubic feet per second capacity at 64-foot head for EL 42.9 pumping plant; one vertical-shaft, turbine-type pumping unit, 3 cubic feet per second capacity at 20-foot head for EL 51.3 pumping plant; and one horizontal-shaft centrifugal-type pumping unit, 32 cubic feet per second capacity at 60-foot head for EL 55 pumping plant for Area E-4 on East Low Canal.	Do	Construction of 7,500-kilovolt-ampere Tyndall substation.
Do	Construction of 19 miles of unlined Potholes East Canal, 470 cubic feet per second capacity, including concrete chute and stilling pool, concrete drop and stilling pool, 8 concrete checks; and construction of Pasco wasteway turnout and chute, Pasco wasteway, and 7 county bridges, near Ringold, Wash.	Do	Construction of 10,000-kilovolt-ampere Armour substation.
		Do	Construction of 15,000-kilovolt-ampere Beresford substation.
		Do	Construction of 15,000-kilovolt-ampere Flandreau substation.
		Do	Construction of 10,000-kilovolt-ampere Groton substation.
		Do	Construction of 2,500-kilovolt-ampere Wall substation.
		Do	Construction of 3,750-kilovolt-ampere Philip substation.
		Do	Construction of 5,000-kilovolt-ampere Midland substation.
		Do	Construction of 2,000-kilovolt-ampere Wicksville substation.
		Do	Construction of metal or concrete block warehouses and storage garages at Armour, Sioux Falls, Watertown, and Philip substations.
		Riverton, Wyo	Furnishing and applying asphalt lining on about 11 miles of Wyoming canal and Badger lateral.
		Shoshone, Wyo	Construction of 4,400 feet of open drains, 2,885 feet of closed 10-inch tile drain and 7 structures on Heart Mountain division near Cody, Wyo.

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THE RECLAMATION AREA

The Reclamation ERA

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FEATURE ARTICLES

SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1.50 a year for persons residing in the United States and Canada; $2 a year for foreign subscriptions; special rate of $1 a year for members of water users' associations, and Bureau of Reclamation employees.

OUR FRONT COVER

Season's Greetings

Federal Reclamation, in the figurative form of Santa Claus, presents the Nation with food of all kinds from his horn of plenty. Photo by Phil Merritt, Region 1, photographer.

30 YEARS AGO IN THE ERA

Greetings to our Project People

To Okanogan, on the North, and Yakima just b looking out upon the snowy crests of the Cascade Klamath amid her forests and lakes; to Umatilla, b the mighty Columbia; to Orland, project of no reg to Newlands, the milk and honey land; Yuma and River, our tropic gardens; Rio Grande, the leader in eration; Carlsbad, in the land of turquoise skies, compahgre, blessed by the Gunnison's flow; Grand V where dreams come true; Strawberry, the promised of the Saints; Flathead, the new land of Opportunit Minidoka, where night is dispelled and labors lessen harnessed lightning; and Boise, gem of Idaho's f valleys; to King Hill, the adopted child of the servic Milk River, Lower Yellowstone, Sun River, and Hu Montana's quartette; to Belle Fourche, shadowed b pines of the Black Hills; to Williston on the Big Mu to Shoshone, the Land of Fulfillment; to the North P along the River of Castles; Riverton, soon to blossom to Fort Peck and Blackfeet, our Indian projects, we ex felicitations and best wishes for a Merry Christmas.

(From p. 550 of the December 1921 issue of the R MATION RECORD, predecessor of the RECLAMATION I

RECLAMATION PLACE NAMES IN THIS ISSUE

Reclamation's Golden Jubilee

by Michael W. Straus, Commissioner
Bureau of Reclamation

Extracts from Commissioner Straus' address of October 18, 1951, during the Twentieth Annual Convention of the National Reclamation Association at Amarillo, Tex., containing important official policy statements and a year-end report on the status of the Bureau of Reclamation's program.

Reclamation's Golden Jubilee will occur on une 17, 1952. Let us take a look back over our alf century of experience. We have a tendency dwell on the changes that have occurred. What want to emphasize now are some changes which ave not occurred.

The Reclamation program began as a measure or improving lands sufficiently to attract home-eaders and expand western opportunities. To-ay, the Reclamation program irrigates both rivate and public lands, providing supple-ientary as well as full irrigation, bolsters private umping operations as well as public surface iversions, and services whole regions as units. These are tremendous changes in the scale and cope of the program; but the ultimate purpose as not changed. It remains today, as it was n 1902, to open barren or inadequately watered ands to settlers and to fill the land with independ-nt farm families.

The Reclamation program began without tax ppropriations. Works on the modern scale were ndreamed of. Today, the taxpayers invest about quarter of a billion dollars each year in the pro-gram, and Reclamation undertakes, in its stride, asks greater than any proposed before in man's istory. Yet the economic and financial prin-iples underlying this program have not changed. The tremendous modern projects, like the modest arly ones, are still basically self-liquidating and he major costs are still repaid by the water and ower beneficiaries.

When Reclamation began, power was at most n incidental technical matter, something an in-genious engineer would pick up to help provide electrical energy for his construction job, such as on the Salt River, Boise, North Platte, Strawberry Valley, and other projects. Today, power is one of the main piers on which rests the entire Reclamation structure, an integral and inseparable part of the operation, a benefit ranking generally with the irrigation benefit itself, but far ahead of the irrigation it makes possible when it comes to paying the bill. From April 16, 1906—the day when the Federal Government first took legislative cognizance of Reclamation power—up to the hectic present, the principles under which that power is made available to the American people have remained unaltered. It is sold preferentially to public bodies and cooperatives; sold in such a way as to assure widespread use and to prevent monopolization, and sold at the lowest possible cost consistent with sound business principles.

Reclamation began with single-purpose irrigation projects. Today, it is based upon gigantic multiple-purpose projects consciously designed to develop entire river systems. Yet from the days when the first two power plants were installed at Roosevelt Dam in Arizona and in the Strawberry Valley in Utah, Reclamation has never been satisfied with half measures. Today, as then, it conceives its duty to consist of getting every benefit possible from the water resources brought under control. Today, as then, it sees each project with its various but interrelated benefits as an integrated unit.

And, in our golden jubilee year, let us remem-

(Please turn to page 286)

FIGHTING CORROSION WITH CORROSION

ARMOR OF ANODES FOR IMPERIAL DAM. At left, graphite anodes safeguard submerged portion of roller gates. At right, suspended anodes protect the 24 scrapers at the Imperial Dam and Desilting Works at the Colorado River. *Photo at left by S. T. Larsen, Design and Construction Division, Denver, Colo., at right by Samuel B. Watkins, Region 3 photographer.*

**by J. L. GILLILAND and N. G. NOONAN, Engineers, Design and Construction Division
Denver, Colo.**

WHAT'S A GOOD WAY TO FIGHT CORROSION? What is an effective and cheap method of combating this insidious force which attacks metal irrigation structures and annually takes huge bites out of the water users' pocketbooks?

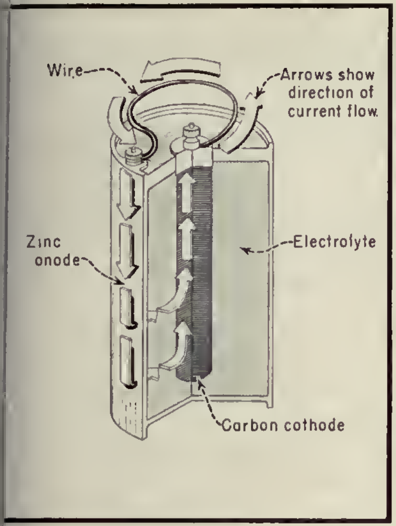
Reclamation engineers say one answer to these questions is to fight fire with fire, or more aptly, to fight corrosion with corrosion, by using a tool called cathodic protection.

Cathodic protection, which uses certain inherent electrical properties of metal, is proving to be one solution to the problem of reducing the large red-ink item of corrosion on the Bureau's operation and maintenance books. Good quality paint work is still the Bureau's first line of defense. But fighting corrosion with corrosion—which essentially is the principle of cathodic protection—will result in a great decrease for this destructive and costly element in Reclamation operation and maintenance work.

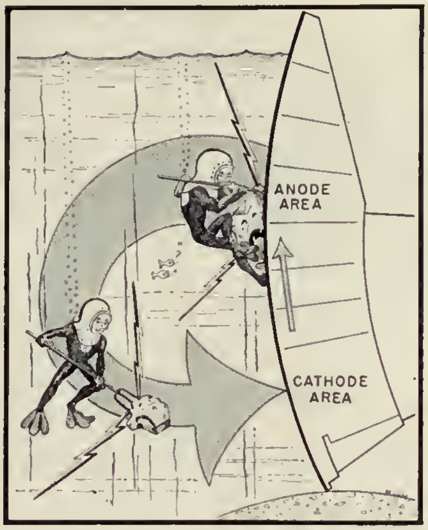
To appreciate the significance of this achie ment and its vast importance in Reclamatio activities, let us summarize briefly the over- corrosion picture.

Fundamentally, corrosion is an electrical— more accurately, an electrochemical—process. C tain metals, particularly steel, embody witl themselves the electromotive seeds of their o destruction. Metals such as those used on irri tion structures on Bureau projects contain va ing degrees of electrification within themselv technically known as potentials. In the prese of water containing dissolved salts, an eternal t angle is developed between the areas of differ potentials called anodes and cathodes, both witl the metal, and the surrounding water, called t electrolyte.

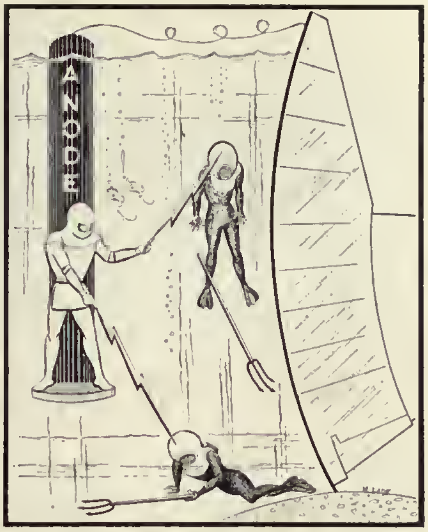
Corrosion is the result of an electric curr generated by the difference in potentials wh flows from the anode through the electrolyte b to the metal at the cathode side. When the el trical current flows through the water it dissol metal from the anode area. Dissolved iron, u exposure to air or oxygen in the water, produ rust. As pitted areas develop, they are surroun by a wall of rust. Although these currents very small, their over-all effect is vastly destr tive. For example, a small amount of electri current continuously leaving a metal surface m



KE A DRY-CELL BATTERY, when the electric rrent flows from the zinc anode to the rbon cathode, it removes zinc particles as leaves the anode, thus corroding the dry-ll case. The battery operates because ere is an electric difference in potential tween the zinc and carbon.



CORROSION RESULTS FROM ELECTRIC CURRENT, generated by the difference in potentials flowing from the anode to the cathode areas. Physical or chemical variations in submerged metal structures, like the radial gate above, generate this current.



A SACRIFICIAL ANODE takes the corrosive action upon itself, turning the radial gate into a cathode. The protective anode is connected by a wire to the submerged metal structure. *Illustrations by Marie L. Lang, Design and Construction Division, Denver, Colo.*

ıke as much as 20 pounds of metal with it within year.

Bureau engineers took a long look at this basic orrosion phenomenon and borrowed a page from ıe book of experience of pipeline engineers who ave solved the similar problem of corrosion on nderground steel pipelines. The Reclamation esearchers have mitigated the action of corrosion y introducing another element which acts to break p the usual self-destructive process. They have dded a material which acts as an anode, causing ıe entire metal irrigation structure to become ıe cathode. In other words, the new material is n expendable anode which takes the destructive orrosive action upon itself and at the same time rees the structure from any further damage—thus ghting corrosion with corrosion. The expendble material is called a sacrificial anode because t is consumed in the process of protecting the tructure.

Two methods of cathodic protection are used—ne called the galvanic method, the other the elecrolytic method. The galvanic method, operating ıtomatically, employs a metal anode sufficiently lifferent in potential than the metal to be proected, and containing within itself the electrical nergy required to protect the structure. The lectroyltic method, however, requires an external ource of direct current, usually obtained through rectifiers—devices which change alternating current to direct current.

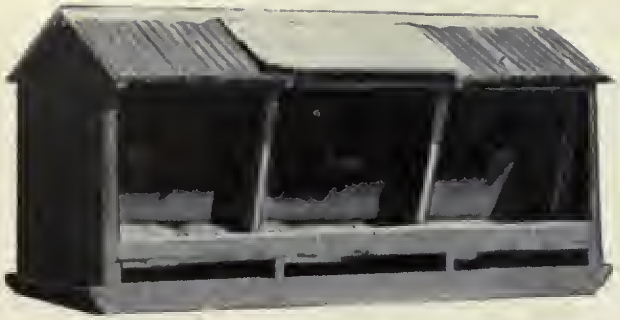
Zinc and magnesium are used primarily as anodes for the galvanic method of cathodic protection. Because of its large storage capacity for electricity, however, magnesium is the most commonly used galvanic anode. Several materials, including graphite, iron and aluminum are used as anodes to "take the rap" in the electrolytic method.

Reclamation engineers are using both methods of cathodic protection. Their first installation now protects the 72 125-foot-diameter revolving scrapers and submerged metalwork in the three basins at the Imperial Dam and desilting works on the Colorado River. The protective anodes are hung from cables which are supported by 30-foot high wooden poles. Here, the electrolytic method is used, electricity being supplied by rectifiers. Each basin of 24 scrapers requires from 60 to 90 amperes to protect 60,000 square feet of metalwork.

Various types of anodes were tried at the desilting works, including scrap steel rods, which are cheap but must be replaced at about 6-week intervals, and graphite anodes which promise to last a year or more.

The electrolytic method is also used to safe-

(Please turn to page 276)



SELF-FEEDER type of container for range feeding salt-feed mixture in use by Roy Cowden's ranch south of Seligman, Ariz. See plans.

Feeding Salt to Livestock

by E. B. STANLEY, Animal Husbandman, College of Agriculture and Agricultural Experime Station,

University of Arizona, Tucson, Ariz.

SOMETHING NEW IN LIVESTOCK PRODUCTION has been developed in Arizona.

Cattlemen are mixing salt with cottonseed meal and other supplementary foods to livestock on the open range or pasture. As a result the range animals eat what is good for them, and no more. In addition, this self-regulating use of supplementary feed helps to solve the problem of supporting livestock on drought-stricken desert land.

The advent of self-feeding salt-feed concentrate mixtures to range cattle makes an eventful development in livestock production—particularly in the western range country. It may well be regarded as a contribution of unparalleled significance to the range cattle industry, the major credit for which belongs to Arizona cattlemen and allied interests The unqualified endorsement of this ingenious practice and its evaluation in the superlative is unquestionably warranted. Some of the conditions that led to the use of salt in this new role and its subsequent widespread adoption throughout this State and elsewhere are worthy of mention.

It should be understood at the outset, that sa is employed directly to regulate consumption the feed with which it is combined, and indirectl to effect an increased consumption of essenti food nutrients for the range cow. The extensi nature of our range lands have confronted stoc men with the insurmountable barrier of providi supplemental feed regularly each day to nee cattle. A solution to this age-long problem a rived with the discovery that mixing salt with co tonseed meal or other feed concentrate would a tomatically limit their consumption to a desir level. Outright misgivings greeted the first r ports of this practice. It was condemned as u orthodox and unscientific. Any conception that was the beginning of a new era in range livesto feeding probably did not exist.

Grass and other native vegetation in this ar is the sole feed resource of a very large number our beef cattle and sheep population. Despite i invaluable use for this purpose, depending up herbage vegetation confronts the livestock indu try with its most outstanding problem. T greatest difficulty to cope with in this regard is t unpredictable nature and irregularity of the fe supply. A constantly changing nutrient conte adds to the complexity of this prevailing conditio

It is in this capacity that the salt-feed mixtu has its greatest virtue. With access to feed suppl

TAKING TURNS, cafeteria style, for a salt-feed mixture on the Coyote Springs Ranch, in Lonesome Valley near Prescott, Ariz. Photos submitted by the author.

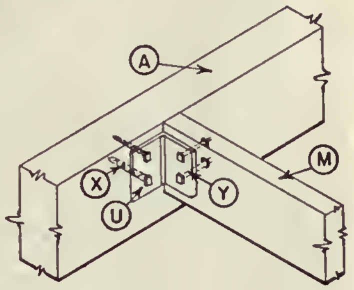
ents when the range forage supply declines be-
w adequate levels, livestock can satisfy their
ormal feed requirements and maintain a con-
nuity of growth so essential to efficient livestock
roduction.

Cottonseed meal or cake has served an im-
ortant role as a range supplement feed. It was
e logical choice to adulterate with salt. In addi-
on to needed protein it provides both phosphorus
nd readily available energy producing nutrients.
eficiencies common among range cattle grazing
weathered mature forage are protein, energy
digestible nutrients), phosphorus, and vita-
in A. Range forage with less than 6.5 to 8 per-
nt crude protein and 0.15 percent phosphorus is
ficient in these essential nutrients. Diminished

(Please turn to page 288)

MAKE YOUR OWN OPEN-AIR CAFETERIA FOR LIVESTOCK. Here are detailed plans for a covered self-feeder container with trough insert attachment, portable, and of 1,000 to 1,500 pounds capacity, drawn up by the University of Arizona Agricultural Extension Service, Tucson, Ariz. They call this a Portable Cattle Self Feeder. *Plans made available by the author.*

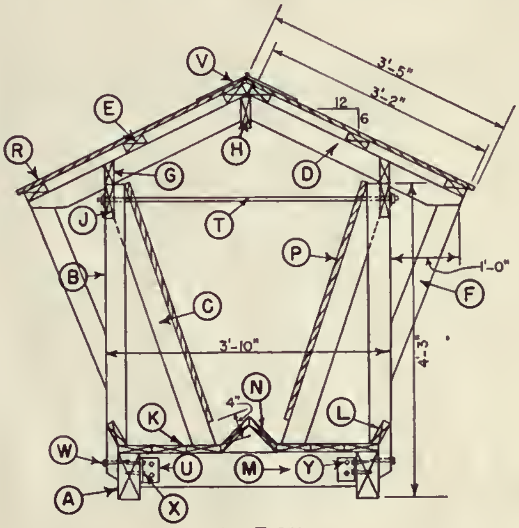
DETAIL OF ANGLE CONNECTION



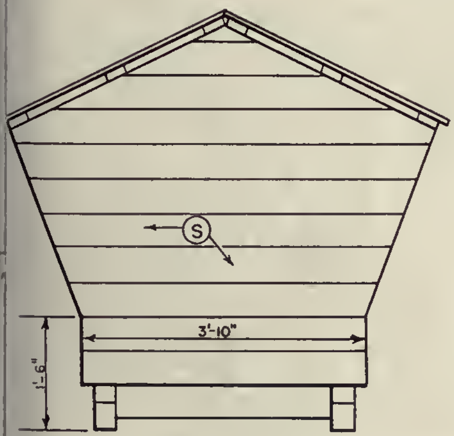
BILL OF MATERIALS

No.	Quantity	Size	Title
A	2	4" x 8" x 10'-0"	Skids.
B	8	2" x 4" x 4'-0"	Columns.
C	8	2" x 4" x 3'-9"	Supports.
D	8	2" x 4" x 3'-2"	Rafters.
E	6	2" x 4" x 9'-11"	Purlins.
F	4	2" x 4" x 2'-7"	End supports.
G	6	2" x 4" x 3'-0½"	Blocking.
H	1	2" x 6" x 9'-7½"	Ridge.
J	2	2" x 6" x 9'-7½"	Stringers.
K	6	2" x 6" x 9'-7½"	Flooring.
L	6	2" x 6" x 3'-0½"	Bankboard.
M	4	2" x 6" x 2'-11"	Joists.
N	2	2" x 8" x 9'-7½"	Flooring.
P	14	1" x 6" x 9'-7½"	Sheeting.
R	22	1" x 6" x 3'-5"	Sheathing.
S	[1] 70	1" x 6"	Sheeting.
T	4	½" dia. rod x 4'-0"	Tie (nuts and washers).
U	8	3" x 3" x ¼" L x 4"	Clip L's.
V	4	9"	Strap hinges.
W	8	⅜" dia. x 5"	Lag screws.
X	16	¼" dia. x 3"	Do.
Y	16	¼" dia. x 2½"	Bolts (nuts and washers).

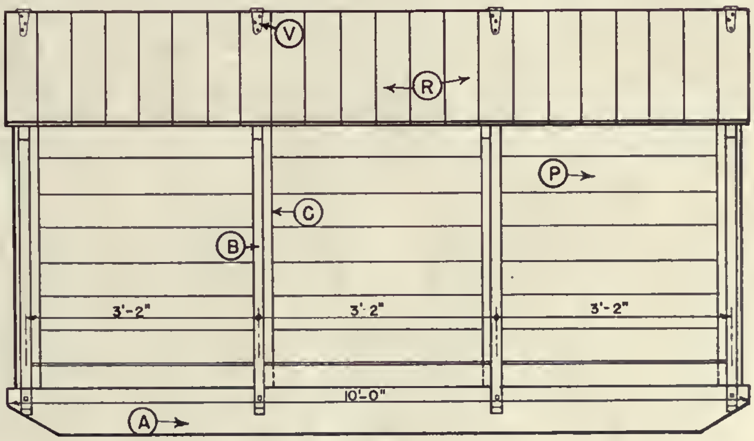
[1] Linear feet.



SECTION



END ELEVATION



SIDE ELEVATION

JACKING UP THE GATE *of the Pleasant Valley Dam meant that Reynold L. Johnston, manager of the Pleasant Valley Irrigation Co., had to crawl the length of the 240-foot tunnel with heavy equipment to renovate the outlet gate. Photo by Stanley Rasmussen, Region 1 photographer. Artist's impression of Reynold at work by Lloyd Chellman, Graphics Section, Washington, D. C.*

Ingenuity Keeps the Water Flowing

by R. B. HILL, Irrigation Engineer,
Region 1 Headquarters, Boise, Idaho

How to operate the outlet works of a reservoir, with the stem of the slide gate sheared off at the gate level under 34 feet of water is a knotty problem.

It was the seemingly insurmountable predicament that recently faced R. L. Johnston, manager of the Pleasant Valley Irrigation Co. in southern Idaho. How he ingeniously overcame the difficulty at a total material cost of $300 and kept the farms supplied with water is the subject of this story.

The Pleasant Valley Irrigation Co. operates a reservoir, known as Pleasant Valley Reservoir, on Ten Mile Creek, about 10 miles south and 3 miles east of Boise. It supplies water for a small number of farms along the creek above the Bureau of Reclamation's Boise project.

The irrigation supply is impounded by an earthfill dam about 40 feet high. The discharge tunnel through the dam, measuring 30 inches wide and 32 inches high, extends 260 feet downstream from the control gate. The first, or upstream 3½ feet of the tunnel, passes through a 30-inch steel pipe, encased in concrete. The gate itself, made of cast iron 3 feet wide by 4 feet high, had been raised and lowered by a manual worm gear hoist, mounted on top of a vertical wooden tower, 46 feet abo[ve] the gate.

In February 1950, during a severe windstor[m] the wooden tower was blown over, shearing off t[he] gate stem at a point just above the outlet ga[te] which was then under 34 feet of water.

Johnston sought to secure a diver to repair t[he] gate stem. Indicated costs appeared prohibiti[ve] and there was no assurance that the job could [be] completed successfully.

But Johnston was not discouraged. He had [an] idea. Despite the cramped quarters in the 26[0-] foot tunnel, Johnston believed he could raise a[nd] lower the gate as much as 8 inches if he cou[ld] fasten the base of a double-action hydraulic ja[ck] to the outlet pipe with the oil-driven stem of t[he] jack attached to the gate.

Accordingly, he attached the jack inside a ste[el] band, which in turn he fastened inside the outl[et] pipe as near the gate as possible. The jack ste[m] head was then attached to the discharge gate.

Johnston made the steel band of 1¼- by [...] inch stock, with the outside diameter slight[ly] smaller than the 30-inch inside diameter of t[he] outlet pipe. He drilled ¾-inch holes at interva[ls] of approximately 6 inches around the steel ban[d]. Then despite lack of working room at the u[p]stream end of the tunnel and the continual spra[y] of water leaking around the gate, he used a te[...]

T[ee-Firm Combine Starts Eklutna Tunnel

Secretary of the Interior Oscar L. Chapman on ptember 17 announced the award for construc- n of a 4-mile long, 9-foot transmountain water ersion tunnel and appurtenant facilities on the lutna project in Alaska for defense and in- strial electric power in the Anchorage area. e successful bid of $17,348,865 was made by Palmer Constructors of Omaha, Nebr., a three- m combine made up of Peter Kiewit Sons, Coker nstruction Co., and Morrison-Knudsen Co.

Under the terms of the new bid the Bureau of clamation will save almost 4 million dollars. previous offer of $21,321,695 last June was re- ted because the cost was considered excessive. The contract provided for construction to begin t later than October 17, 1951 and be completed ptember 1954. When the steel-helmeted engineers started drilling the tunnel it marked the first major contract ever awarded by the Bureau for work on a project outside the mainland of the United States. Besides the tunnel, which will be driven through Goat Mountain to Knik Arm, an inlet of the sea, the job also calls for the construction of a 9-foot diameter concrete gate shaft, a concrete surge tank, 30 feet in internal diameter, and a penstock tunnel, with installation of a 7½-foot diameter penstock. The contractors must also make some alterations on the existing Eklutna Dam.

(See the following issues of the Reclamation Era for additional information on Eklutna: Alaska Far from Forgotten Land—January 1949—page 1, Eklutna Number One Job in Alaska—February 1949—page 35, Reclamation on Ice—April 1949—page 95, Eklutna Reports Goes to Congress—January 1950—page 18, and Byron G. Felkner to Engineer Eklutna—November 1950—page 208. ●

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ate and drilled matching holes in the steel out- pipe.

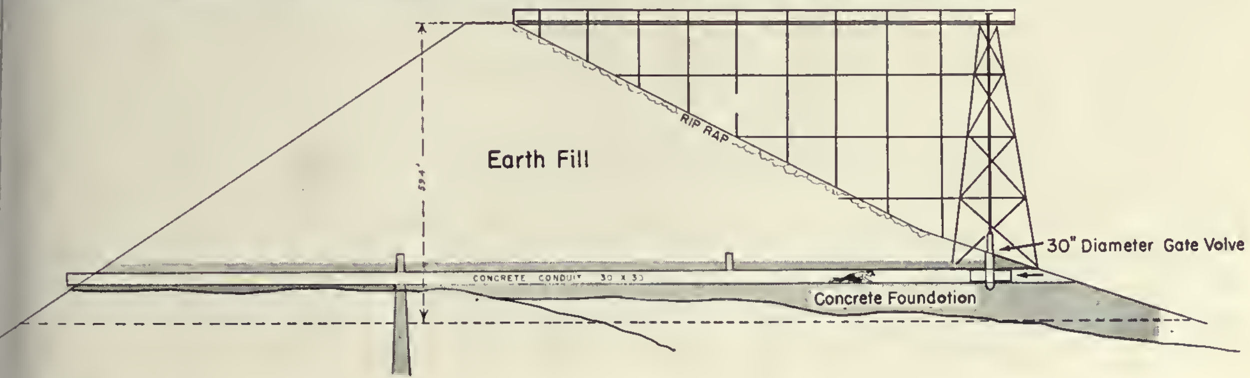
Before mounting the steel band in place, he lded the base of a double-action 5-ton hydraulic ck to the inside of the steel ring. He welded a avy angle iron to the head of the jack stem. hen slowly, inch by inch, Johnston dragged the sembled steel ring and jack the entire length of e 260-foot tunnel and attached the ring inside e outlet pipe by means of ¾-inch stud bolts. The ng was placed so that the base of the jack was an inverted position against the top of the steel ng and outlet pipe. With the jack stem fully ex- nded, one lip of the angle iron rested squarely ainst the cast iron discharge gate. With this uipment in place, he then drilled and threaded oles in the gate and bolted the angle iron to the ate.

To provide power for raising and lowering the gate, Johnston fabricated a small oil pressure pump which was placed near the tunnel outlet. The pipelines, to translate the oil pressure from the pump to the hydraulic jack, consisted of two lines of ½-inch galvanized iron pipe, each about 300 feet long. In order to bleed the lines and remove all air, valves had to be placed on the pipes at points near the hydraulic jack. This meant that Johnston had to be at the upper end of the tunnel during the tryout of the pump to open and close the valve.

The lines were successfully bled and the gate was opened sufficiently to deliver an ample water supply to the farms dependent on Pleasant Valley Reservoir in 1950. Thus what seemed to be an insurmountable predicament was overcome by one man's ingenuity. The End.

T GAVE ME AN EERIE FEELING," said Mr. Johnston, to know was so far under water, and hearing the echo of every sound s he renovated the outlet works of the Pleasant Valley Dam.

Drawing by Lloyd Chellman, Graphics Section, Washington, D. C., based on cross-section diagrams obtained through the courtesy of the Idaho State Reclamation Engineer.



SAVING THE SOIL—at left, three rock check dams constructed fram material available at the site, hol back streams that run rampant after heavy rains Below, brush check dams which retain materia washed down the gullies. Both are vital parts o the erosion cantral pragram in the Keswick reservoi and watershed area. *Phatas by J. D. Leeper, Regio 2, photographer.*

EROSION CONTROL at Shasta and Keswick

by LOUIS G. TEMPLE, Landscape Architect
Shasta Dam, Calif.
Region 2 (Headquarters at Sacramento, Calif.)

Control of soil erosion, which has been a world-wide problem for ages, is being tackled with vigor by Bureau of Reclamation crews on the Keswick Reservoir watershed in northern California, where heavy rainfall and lack of vegetation have combined to seriously threaten the useful life of the reservoir.

In attacking this problem, as a part of the Bureau's soil and moisture conservation program. Reclamation crews not only are saving thousands of tons of soil, but in the words of Patrick Henry, they are being patriotic.

Most Americans are familiar with his famous statement, "give me liberty or give me death," but very few knew that this great Revolutionary War figure also defined a patriot as "the man who stops the most gullies."

Ample opportunity exists for the crewmen to qualify under this definition of patriotism, for the hills surrounding both Keswick and Shast Reservoirs are literally being washed away b rainfall, coursing through deep gullies.

From the turn of the century until abou 1925, acrid fumes from smelters located in th Sacramento River canyon north of Redding Calif., practically denuded the watersheds.

The average annual rainfall in this area is abou 62 inches, with 100 or more inches not uncommo and nearly all of this rainfall occurs during th winter months.

Since the advent of the smelters, the steep water sheds have been literally gutted by water erosion carrying hundreds of thousands, if not millions, o tons of soil into the Sacramento River. Prior t the construction of Shasta and Keswick Dams annual flooding of the Sacramento River sluice the eroded soil through the canyon and on dow the valley. Now, due to an extensive erosion con trol program, this eroded soil remains in plac

Natural recovery of vegetation on these water sheds ranges from very poor in the totally denude areas, to moderately good in the less devastate eas. However, the gullies continue to grow eper and wider, undercutting much of the tural vegetation, even in the better section.

Keswick Dam, located approximately 7 miles wnstream from majestic Shasta Dam, forms a mparatively small, shallow reservoir for regulating water released from Shasta Dam. A ree-unit power plant of 75,000-kilowatt capacity located at Keswick Dam.

The relatively small capacity of the Keswick eservoir, plus the semibarren and badly eroded atersheds, created a serious problem. A method f holding the soil on the watersheds had to be und in order to prolong the life of the reservoir nd powerplant. After 3 years of investigation nd experimental work, a three-phase plan was dopted.

(*a*) Construct a series of inexpensive check ams in all gullies, extending from the reservoir o the upper slopes of the watersheds, using whatver material available at the dam sites, such as ocks, logs, and brush.

(*b*) Establish broadleaf native plant material round the check dams and on all denuded areas.

(*c*) Reforest the area by planting Ponderosa and Jeffrey pine seedlings on the watersheds.

Actual work on this three-phase plan was started in December 1949 and the plan has since proven highly successful.

Usefulness of the check dams does not cease when the reservoirs behind the dams become filled with eroded soil. Instead, they act as steps, letting the water down the steep slopes in easy stages, with each step breaking the velocity of the stream. The broadleaf native shrubs planted at each check dam will eventually form living barriers, increasing the efficiency of the dams.

By the beginning of October this year, the crews in the Keswick Reservoir watershed had built 50,000 check dams. In addition, they had planted nearly a million acorns, over 100,000 broadleaf plants, and a half a million Ponderosa and Jeffrey pine tree seedlings.

The check dams alone, according to estimate, have prevented approximately 7,500 cubic yards of silt from being carried into the Keswick Reservoir.

This work has been in progress for about three years and two more years will be needed to complete the program. THE END.

OSING THE SOIL. **This view of an uncontrolled area around the eswick reservoir shows deep gullies caused by streams from eavy rains. Eventually, shrubbery will hold the soil on these hillsides and protect the reservoir from tons of soil and debris washed down by these streams.** ***Photo by J. D. Leeper, Region 2 photographer.***

Free —

In the early days of Federal Reclamation, settlers on new projects took 5 to 10 years to bring their farms under irrigation. No man had the facilities to transform his sagebrush land into a fully irrigated farm in a single season.

More recently, with modern machinery and improved methods, new farmers on western reclamation projects have set a much faster pace, oftentimes bringing their holdings under cultivation in the matter of a few months.

But what will be a world's record in the transformation of a piece of dry sagebrush land into a fully developed farm will be set next year on the Columbia Basin project in eastern Washington. There, in a single day, 80 acres of land will be cleared and leveled, the crops planted, the distribution system put in, the fences erected, a three-bedroom house constructed and fully furnished, all of the outbuildings built, farm machinery moved on, and livestock and poultry provided.

The stunt, known as a "Farm-in-a-day" or "Dawn-to-Dusk" operation, is a highlight of a 5-day celebration that the State of Washington is staging to herald the initial delivery of water to the first of a million acres of irrigable land. A committee, appointed by Gov. Arthur B. Langlie, has planned a program that is scheduled to be one of the greatest public celebrations ever held in the West. It will also feature pageants, wate follies, carnivals, dancing, a mass church spectacle and dozens of other spectacular events.

The farm, worth $50,000, will be given awa free to the most worthy veteran in the Unite States in recognition of the contributions the sol diers of America have made toward the moldin of the national solidarity that makes projects lik the Columbia Basin development possible. Th awarding of the prize to this veteran involves Nation-wide search, now being conducted by th Veterans of Foreign Wars through posts in ever city and hamlet in the United States.

Any veteran of World War II or the Korea war is eligible to receive the farm. All he has t do is to get the rules and regulations from his loca V. F. W. post or national headquarters at Broad way and Thirty-fourth Street, Kansas City, Mo and submit a statement outlining why he think he deserves to get the farm.

No fancy writing is required. He should stre his status in the war and in civilian life, wit special emphasis on any unusual circumstance that he feels warrants consideration. The vetera selected will play a key role in the ceremonies a which the first water for the Columbia Basi project is delivered.

The case of the most deserving veteran fro

A $50,000 IRRIGATED FARM

FOR THE NATION'S MOST WORTHY VETERAN. Waste land like that on the opposite page will be transformed into a productive farm like the one above as a highlight of the celebration marking the initial delivery of water to the million-acre Columbia Basin project next year. The Bureau's predevelopment farm, above, is near the site of this "Farm-in-a-Day" program. *Photo on opposite page by F. B. Pomeroy, photo above by A. W. Bauman; both are Region 1 photographers.*

ach of the posts will be judged by a State board f judges and the case of the most deserving vetrans in each of the States will then be judged y a national board of judges, which will select he winner.

In an effort to prevent overlooking the most leserving veteran, Hubert Walter, chairman of he Columbia Basin Celebration Committee, asked eaders of the RECLAMATION ERA to help the V. F. W. find this person.

"We suspect that some of the most worthy vetrans will be shy about entering their names in he search," Walter said. "Therefore, we hope hat people reading this article who know of deserving cases will help these veterans get their rules and regulations and enter their statements. We want to find the person about whom everyone will say, 'Isn't that swell? That guy sure deserves a break.'"

While only one $50,000 irrigated farm is available through this celebration, the Bureau of Reclamation will offer to other veterans new opportunities to undertake irrigated farming on several projects during the next few years. These are listed at right. Anyone wishing to get an application form to apply for these lands should write to the office shown. Also see pages 288 and 289 of this issue for 1951 opportunities.

1952

FOR SALE—80 units, comprising 4,610 acres, on the Columbia Basin project, Washington. January and February 1952. *Write to Ephrata, Wash.*

HOMESTEADING—11 units, comprising 887 acres, on the Coachella project, California. June 1952. *Write to Boulder City, Nev.*

30 units, comprising 3,900 acres, on the Riverton project, Wyoming. June 1952. *Write to Billings, Mont.*

1953 (tentative)

FOR SALE—9 units, comprising 1,300 acres, on the Gila project, Arizona. August 1952. *Write Boulder City, Nev.*

FOR SALE—37 units, comprising 2,823 acres, on the Columbia Basin project, Washington. January and February 1953. *Write to Ephrata, Wash.*

52 units, comprising 7,700 acres, on the Gila project, Arizona. October 1953. *Write to Boulder City, Nev.*

HOMESTEADING—8 units, comprising 640 acres, on the Coachella project, California. June 1953. *Write to Boulder City, Nev.*

25 units, comprising 4,215 acres on the Riverton project, Wyoming, and 6 units, comprising 720 acres, on the Shoshone project, Wyoming. February 1953. *Write to Billings, Mont.*

1954 (tentative)

FOR SALE—130 units, comprising 11,033 acres, on the Columbia Basin project, Washington. January and February 1954. *Write to Ephrata, Wash.*

23 units, comprising 3,500 acres, on the Gila project, Arizona. October 1954. *Write to Boulder City, Nev.*

HOMESTEADING—50 units, comprising 8,250 acres, on the Riverton project, Wyo. February 1954. *Write to Billings, Mont.*

Fighting Corrosion With Corrosion

(Continued from page 267)

guard the roller gates at Imperial Dam; graphite anodes are suspended in the reservoir. In addition, some of the Imperial bypass gates are protected by the galvanic method utilizing anodes of magnesium and zinc. The magnesium anodes are long magnesium wires embodying an iron wire core. This core holds the anode together until the magnesium has expended itself protecting these vital structures.

The upstream face of one 21- by 17½-foot radial gate is protected by ten 15-foot lengths of the magnesium anodes hung on the gate. The downstream face is protected by five 20-foot lengths hung horizontally. Six zinc anodes, strips 9 inches wide and one-sixteenth inch thick, are fastened vertically to the upstream face of another gate.

The effectiveness of this cathodic protection at Imperial Dam is measured through the use of small metal plates called "coupons." The coupons, widely used to predict the rate of corrosion, are removable plates of the same material as the metal structure and are exposed to the same corrosive conditions as the structure.

The test coupons removed from the Imperial Dam site installations reveal the magnitude of the savings that are possible through the use of cathodic protection techniques. J. R. Collopy, former Chief of the Operation and Maintenance Division of the Lower Colorado River District, who has spark-plugged this work, estimates that a saving of $36,000 a year will result over previous methods of maintenance. On the basis of square foot of metal protected, he estimates the annual cost of cathodic protection on these installations at less than 1 cent a year as contrasted to 8 cents a year for cleaning and repainting once every 5 years.

These savings are probably more than can be normally expected, as the Lower Colorado River water is warm and carries a considerable amount of dissolved salts—factors which aid the electrolytic process but which are exceptionally hard on paints. However, the Reclamation engineers consider cathodic protection holds promise of a general victory over the implacable foe of corrosion on certain types of structures. They believe that the expenditures which were formerly used to appease the ravages of corrosion can now be greatly reduced in the water users' budget. THE END.

Hells Canyon Report Sent to Congress

Secretary of the Interior Oscar L. Chapman o October 8 sent to the Congress a report on th Snake River Reclamation project in Idaho with recommendation that the multipurpose Hells Can yon Dam be authorized as the initial phase of th development.

The Hells Canyon development is designed t add more than 1,400,000 kilowatts of prime powe to the Columbia River system in an area wher there is an acute power shortage for defense pu poses. The Secretary also recommended that th initial authorization include the Scriver Cree power features of the Payette unit of the Moun tain Home Division. In addition to the powe features of this unit which amount to almost 10 000 kilowatts of generating capacity, the Payet unit of the Mountain Home division provides f the delivery of irrigation water to 192,000 acres fertile desert land located between Boise an Mountain Home, Idaho. This latter developme is not proposed for authorization at this time.

Supplemental Funds Voted for Four Ne Dams

In the closing hours of the first session of t Eighty-second Congress, the lawmakers, in pas ing the first and second supplemental appropri tion bills on October 20, 1951, made $5,285,0 available for construction on four new reclamati dams—Palisades, Kirwin, Jamestown, and one Vermejo. All of the dams are multiple-purpo structures.

Congress appropriated $2,000,000 for the $7 601,000 Palisades Dam and Power Plant in Ida in view of its importance as a potential produc of 114,000 kilowatts of hydroelectric power for fense and domestic use. The project will also su ply supplemental water for about 650,000 acres land. Preconstruction work has been done on t project in the past and the tunnel contract will awarded this month.

Two of the dams are part of the flood-cont system on the Missouri River. Some $2,500,0 was appropriated for Kirwin Dam, an $18,187,0 structure on the North Fork of the Solomon Riv near Kirwin in central Kansas, the area hit floods last summer. Jamestown Dam on the Jam River in North Dakota received $500,000 for i

COVER YOUR SIPHONS

ANY SIMILARITY between Mr. Myers and the man in the drawing is unintentional and purely accidental. The drawing was based on the story, plus a photo of Mr. Myers kneeling beside the siphon with the dead rabbit and dog. Due to technical considerations, we substituted the above rendition by Lloyd Chellman of the Graphics Section, Washington, D. C., to graphically depict this problem.

From one of our subscribers, Mr. A. I. Myers of Caldwell, Idaho, came an interesting photo and letter the other day, pointing a moral to other reclamation farmers.

It seems that Mr. Myers, who owns land in the Black Canyon Irrigation District of the Boise Project, installed 10-inch cement irrigation siphons to improve the efficiency of his operations. One day a neighbor's full-grown bird dog was chasing a rabbit. The frightened animal, probably thinking that the siphon would be as safe as a hollow log, leaped into the pipe, where he became entangled in the joint of the second **L**. The dog, as is usual with many of his breed, must have underestimated his own size and went into the siphon after the rabbit—and met the same fate. Neither of them could get out of the siphon and before anyone discovered their plight they died.

When Mr. Myers learned of these circumstances, he "locked the barn door . . ." or more precisely, put a board gate on the outlet of the siphon, which will be there whenever the pipes are not in use. Aside from the humane angle of preventing other animals from suffering the same fate, this will keep the water flowing down the ditches. Fortunately, from the standpoint of water deliveries, the dog and the rabbit couldn't get any further than the joint of the second **L**. Had they been able to travel a few hundred feet into the siphon, it would have been quite a job to get the siphon opened up for use this spring. The animals had completely plugged the siphon, rendering it absolutely useless.

Era readers may remember Floyd Roush's article entitled, "Cover Your Siphon and Cut Costs" on page 247 of the December 1949 issue, in which he pointed out the wisdom of covering siphons during the winter months to avoid leaks due to cracks caused by cold weather, and also submitted a design for a cover with a "swinging door" feature for automatic opening and closing.

We welcome similar contributions from our readers which may help other irrigationists to solve the multitudinous problems of reclamation farming.

The End.

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itial construction on a $10,628,000 project. It will provide 540,000 acre-feet of storage for initial use in flood control, and for municipal water. Irrigation features for both the Kirwin and Jamestown projects will be developed later.

An initial appropriation of $285,000 was made for the $2,664,000 Vermejo project to rehabilitate irrigation facilities for 7,200 acres of land near Maxwell in northeast New Mexico. The plan calls for enlarging three existing reservoirs and creating a new reservoir for flood and silt control, plus other repair works.

Chief Engineer L. N. McClellan is completing construction plans and issuing bid notices without delay so that contracts may be awarded and work started at the earliest possible date. •

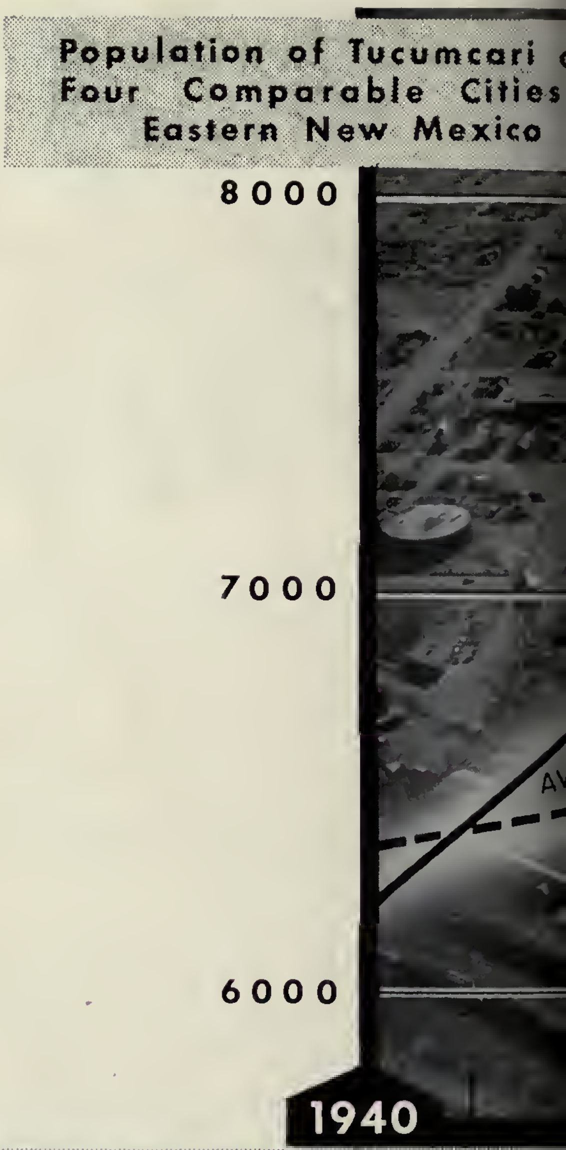
New Mexico experienced two big booms in the middle 1940's. One boom, which occurred at Alamogordo, was activated by ignition of the world's first atomic bomb. The other boom, although far less spectacular, resulted from the Bureau-constructed irrigation project at Tucumcari.

Construction and settlement of the 42,000-acre irrigation project set off a continuing boom in the city of Tucumcari. This formerly small community, located on the dusty and drought-ridden cattle trails and wagon freight routes of the past, and on the railroads, airlines and highways of today, owes its recent growth primarily to the rapidly developing irrigation project that virtually surrounds it.

The Tucumcari irrigation project was launched in 1940, and the first irrigation water was delivered to a part of the area in 1946. Some measure of benefits that flowed into the city of Tucumcari as a result of the irrigation project is reflected in a study of the city's population and business gains as compared to what has happened in four comparable eastern New Mexico cities with such similar economic factors as rail and highway transportation facilities and characteristics of trade areas.

Tucumcari's population increased 35 percent in the last 10 years while the comparable cities gained an average of only 6.4 percent (see graph). The irrigation community's gain was also accompanied by a substantial increase in business activities.

Tucumcari's assessed valuation trebled in the period between 1940 and 1950. Postal receipts,



HOW TUCUMCARI GRE

by WILLIS C. BOEGLI, Division of Operation and Maintenance, Region 5 Headquarters, Amarillo, Tex

building permits and utility connections more than doubled in the same 10-year span. Business activities, which appear to be directly the result of the irrigation project, created over $5,000,000 in bank deposits and $781,000 annually in new construction in the 1940 to 1950 period. This growth, resulting from the irrigation project, also is reflected in a million dollar expansion in public utilities and city construction to accommodate the city's population increase.

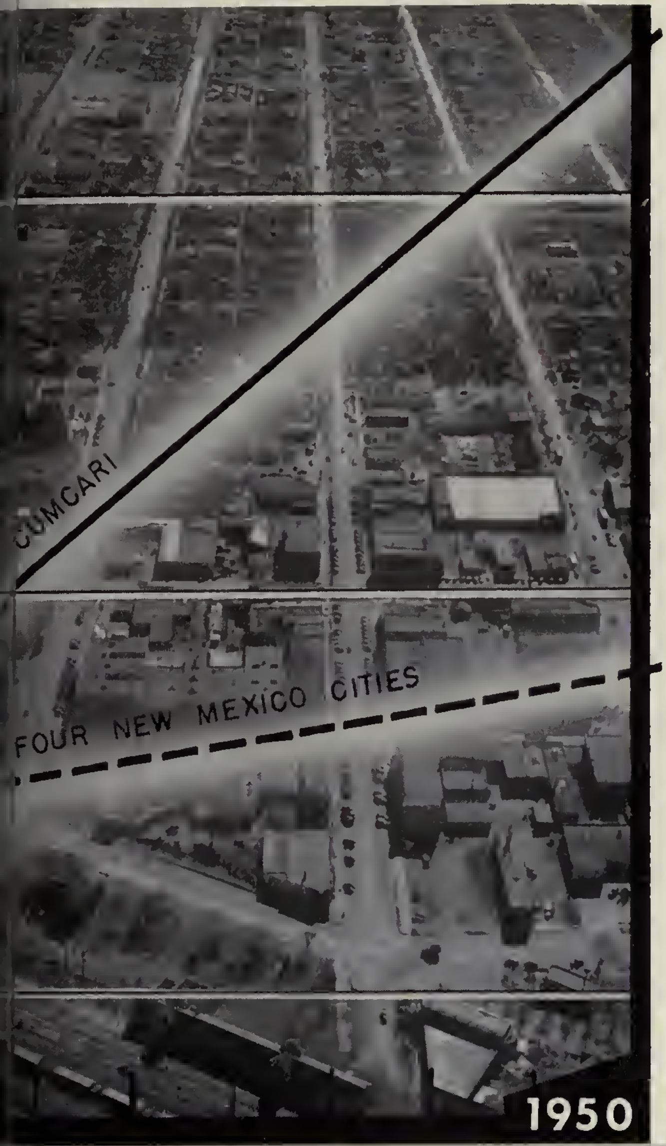
Department of Commerce Business Census reports for 1939 to 1948 show a much greater increase in Tucumcari's business activities than in any of the other four comparable New Mexico cities. The annual payroll for wholesale trades in Tucumcari was 726 percent greater and the number of wholesale establishments 650 percent greater than the average for the other cities studied. Fifty-two new retail businesses were established in Tucumcari during the 1939–48 period while the other comparable cities showed a loss in some retail business activities. The number of persons employed in retail trade in Tucumcari increased 198 percent over comparable cities.

These figures do not reflect the complete story of Tucumcari's progress by virtue of the irrigation project, for considerable expansion in all phases of trade has occurred since 1948 when the business census data were tabulated.

Crops produced on the Tucumcari project in 1949 and 1950 had an average value of more than $1,000,000. Under full project development, crop and livestock values are expected to total about $4,000,000 annually in an area that once could sustain but a few head of cattle during the summer months.

The city of Tucumcari is a part of the Arch Hurley Conservancy District, which has contracted to repay the reimbursable part of the project construction cost. Nonirrigated land in the District, including city property, will repay 20 percent of the District's obligations. Those increases in business activities in Tucumcari, for which the irrigation project is directly responsible, appear to justify the Conservancy District's plan of project repayment under which urban properties repay substantial part of the project's cost.

THE END.



IN POPULATION AND PROSPERITY. In 10 years, as indicated on the chart at left (superimposed over an aerial view of the fast-growing town in New Mexico) Tucumcari topped four cities in the State. Below, two new farm homes, typical of those on the project. *Aerial photo by Dale Hovey, former Region 5 photographer; photos below by Fred Finch, Region 5 photographer.*

GOODBYE TO SUCKERS, like the one being displayed, an enemy of game fish. *Yakima Morning Herald photo.*

ROTENONE AT BUMPING LAKE

by EARL L. SMITH, Engineer-Hydrographer, Yakima Project, Washington, Region 1 (Headquarters at Boise, Idaho)

A STRANGE SIGHT MET THE EYE one cold, gray, early morning last fall on Bumping Reservoir, in the heart of the Cascade Mountains.

Twenty-seven boats, driven by outboard motors, pulling full gunny sacks through the water, isn't something you see every day.

One hiker along the shore, looking at a boat, was heard to mutter, "For the love of mud, what are those two guys doing?"

But those "guys" knew what they were up to. So did the other 52 individuals similarly riding around in boats over other parts of the lake. They were part of a scrap fish eradication crew hired by the Washington State Game Department to spread rotenone in the water to rid this important Yakima project reservoir of suckers, squawfish, and shiners which had driven trout and other favorite sporting fish from the lake.

Today there are 600,000 small trout swimming to their heart's content and unmolested in the cold blue water, planted there by the game department to make this beautiful lake, set like a blue jewel amidst the white, snow-covered crags of the rugged Cascades, the popular recreational area it once was. The operation points to the significance which professional fish and game people attached to Federal Reclamation reservoirs in the Pacific Northwest as outdoor playgrounds for the area's growing population.

The Bumping Lake program is said to be the largest single scrap fish eradication program ever undertaken anywhere in the world. Actual operations began about August 3, when the Bureau of Reclamation began emptying the lake so that a minimum amount of the poison would be required. When full the 4-mile-long lake, which has a surface area of 1,300 acres, contains 62,600 acre-feet of water. When the actual poisoning began in late September, it had been drawn down to 32,510 acre-feet, or roughly 10½ billion gallons.

Robert Rennie, District Fish Biologist, estimated that this quantity of water would require about 43,000 pounds of 5.5-percent rotenone, which was ordered and delivered to Bumping.

An outdoor kitchen was set up to feed the crews who were to help with the poisoning. But as Bumping Lake in the fall is whipped by storms swirling around the high peaks, the weather forced moving the tables inside a summer cabin furnished by Jack Nelson, retired gate tender at Bumping Lake. (See RECLAMATION ERA, December 1946.) He also furnished sleeping accommodations.

The morning before the spreading of rotenone in the lake, two transit-mix concrete trucks arrived at Bumping to mix the material. Each truck was charged with 2,000 pounds of dry rotenone dust and approximately 220 gallons of water. This was just enough water to settle the dust and it caused the rotenone to expand to nearly three times its original bulk.

The mixed rotenone was put in loosely woven gunny sacks, about 1,500 of them, and taken by boat to the shoreline opposite each of 37 sections into which the 659-acre lake had been marked. Markers consisted of large 4-foot black and white numbers on the banks, and bright yellow 5-gallon cans on the lake surface, anchored in place.

The morning of operation rotenone, after a hot breakfast prepared by an eight-man kitchen crew, each two-man team was given a map of the lake showing the sections they were to cover. The poison was spread by dragging the gunny sacks behind an outboard motor boat. The motor was tilted up slightly so as to drive the water against the sack, thereby beating the rotenone out into the water at a much faster rate. Each crew crossed

d recrossed its sections in checkerboard fashion, il the allotted number of sacks of rotenone had n distributed throughout each section in pro- tion to the depth of the water.

A flotilla of 27 outboard-motor boats was used spreading operations. Two boats went up mping River and small streams entering the e, while 24 other boats covered the lake proper. e boat was used by Rennie in supervising the . Small potholes left by lowering the lake were soned by hand or wading.

The actual poisoning began about 8 a. m., and small suckers, squawfish, and shiners in the llow water surfaced shortly thereafter. Since rotenone settles about 8 feet per hour, it was arly noon before many silvers appeared. Huge, ly suckers, some weighing up to 10 pounds, ated on the surface. Fifty squawfish and shiners re counted within an area no larger than a table).

The poison affects the gills, causing the fish to for lack of oxygen. Only marine life having ls is affected by the rotenone. It is believed that ly a part of the fish surfaced, as many were n on the bottom in 8 to 10 feet of water during morning following the poisoning.

Most of the larger scrap fish and silvers were ad the day following the poisoning and the last e fish seen was a sucker "in distress" the second y after. Since there was no sign of life in the ke subsequently, the kill was said to "look fa- rable." Only a few rainbows, cutthroats, and olly Vardens—popular game fish—were seen.

CLEARING OUT THE SCRAP FISH. At left, above, members of the task force at Bumping Lake gather for instructions and equipment. At upper right, loading a few of the 15,000 gunny-sacks full of rotenone. Above, dragging the poison through the water. *Two photos at right through the courtesy of the Yakima Morning Herald. Photo at upper left by the author.*

The outlet gates at Bumping Lake were to be kept closed for approximately 60 days to allow the rotenone to lose its toxicity. However, irrigation needs made it necessary to lift the gates in 50 days at which time the water was still toxic and fish in the lower Bumping River (approximately 12 miles long) were killed.

Because of the planting of 600,000 small trout in the lake, the Fish and Game Department has closed the reservoir to fishing this year. It will be opened at some later date, when the Game Department decides that the fish planted have grown large enough. THE END.

MECHANICAL SIPHON PRIMER

by

LARRY SWARNER, Agricultural Engineer,
Region 1 Headquarters, Boise, Idaho

TO KEEP HIS HANDS AND KNEES DRY, Deschutes project fa Warren A. Snapp devised the siphon primer which he is hol above, and demonstrating in the other pictures. As you Snapp's device is really a "snap." ***Photos by Marvin N. She Assistant County Agent, Jefferson County, Oreg.***

THE ADAGE THAT NECESSITY is the mother of invention has been demonstrated once more on the North Unit of the Deschutes project in Oregon. Here, Mr. Warren A. Snapp, who has farmed 120 acres for the past 2 years on the Agency Plains, has perfected a mechanical device to prime irrigation siphon tubes.

Numerous methods are employed to start small siphon tubes. Probably the most common is to submerge the tube in the irrigation ditch, thus removing the air from the tube. With one h placed tightly over one end of the tube, it is t drawn over the ditch bank. The flow is commen when the hand is removed from the end of siphon tube.

Another method which requires a little pra is to place the tube in the irrigation ditch w the outer side of the curve of the tube tow the irrigation. With one hand, give the t a circular "flip," which brings the one end over bank of the ditch, with the other end under w at all times. The centrifugal force set up by ılar motion forces water out of the discharge of the tube, thus creating the siphon action. method enables an irrigator to start the tube one hand while using the other arm to carry on tubes.

ill another method in common usage is the od of "pumping" the siphon tube. The ir- tor stands on the ditch bank with the siphon in one hand. With a quick action, he forces mpty tube downward into the water. As he gs the tube upward, his hand is placed tightly the upper end of the tube. This quick action peated with the hand removed from the end he tube on the downward thrust and closed tly on the upward thrust. With a little prac- it is possible to start the siphon tube by this ping action in two downward and two upward sts.

r. Snapp tried all of these methods but he dis- l getting his hands and knees wet, especially he cold mornings when it was necessary to ge his irrigation water. He had considerable culty in starting his siphon tubes to irrigate his acres of ladino clover and 20 acres of interme- e wheat grass without experiencing the painful ts of chapped hands. The use of rubber gloves ther materials to keep the water off his hands entirely unsatisfactory. His chapped hands me so sore that after trying all the concoctions curing chapped hands carried by the local drug e, he was still unable to sleep at night because he intense pain.

hile lying awake at night, Snapp's mind rally began to figure out some devices which could be used to start the siphon tubes without getting his hands in the water. It was during one of these wakeful periods that he thought out the useful mechanical device for which he has applied for a patent.

This mechanical device makes use of two levers as illustrated in the above picture. One lever grasps the siphon tube at one end in order that it may be moved into the ditch and out over the ditch bank. The second lever is used to press a sponge rubber ball firmly against the end of the siphon tube after the air has been expelled from the tube by means of the water in the supply ditch. The one end of the siphon tube is then moved out over the ditch bank into its proper place and the sponge ball is released by means of the second lever allowing the siphon tube to flow.

Mr. Snapp, who is always working on some device to make farm work more enjoyable, points out that in addition to keeping one's hands out of the water, the device also enables one to set siphon tubes on soft, wet banks which have not become firm. It also makes it unnecessary for a farmer to stoop down on his knees in mud and water and he states that he can set more siphon tubes with his mechanical device in a given length of time than he can by using his hands.

"It's not only the time saved," says Mr. Snapp, "but it also turns an unpleasant job into an enjoyable task." THE END.

For another interesting idea on siphon tubes read the article entitled, "Bill Ebbs' Siphon Primer" on page 229 of the October 1949 issue of the RECLAMATION ERA.

unicipal Power Contracts Standardized

ecretary of the Interior Oscar L. Chapman approved a standard contract article on resale s for power obtained from Federal projects by icipalities. This resale rate clause is expected acilitate the sale of power to municipal systems at the same time preserve the objective of ntaining the lowest possible rates in order to ourage the widespread and abundant use of tricity. Municipalities have been among the tomers extended a preference by law since the ly days of Federal development of the water urces of the Nation.

he standard clause is applicable to future con- cts of the Southwestern Power Administration l the Southeastern Power Administration as well as the Bureau of Reclamation which operates in the Western States alone, where 31 municipalities are customers of the Bureau, exclusive of those in the Pacific Northwest who are serviced with Grand Coulee Dam power via the Bonneville Power Administration. During 1950 these municipalities purchased 2,832,348,824 kilowatt-hours of energy from the Bureau. The average cost varied per killowatt-hour from 2.57 mills from large power plants to 9.40 mills from small power plants. Even at these low rates, which extended the benefits of low-cost Federal power to hundreds of thousands of western people, the municipalities paid into the Government $5,118,095 to be applied on operation and maintenance of the plants and retirement of the Federal investment in these facilities. •

SHORT CUTS TO WEED KILLING CALCULATION

PART 7. How to Prepare Weed Killers for Woody Plants

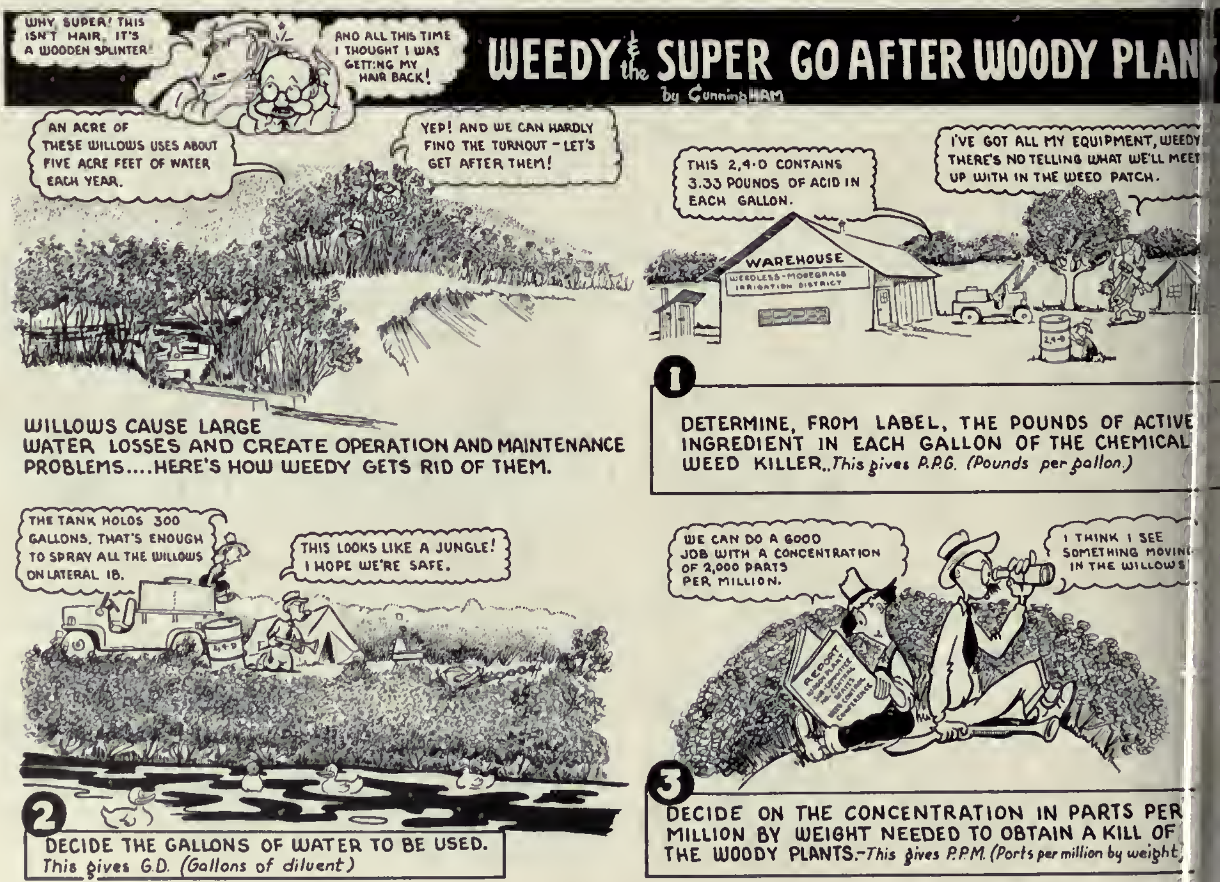
by JOHN T. MALETIC, Weed Specialist and Soil Scientist, Region 7 Headquarters, Denver, Colo.

NOXIOUS WOODY PLANT ERADICATION in the United States costs millions of dollars each year. These plants cause expensive maintenance problems on irrigation systems, along highways, power lines, railroads, and drainage ditches. Above and on irrigation systems they use annually a large amount of water needed for irrigation. Expensive mechanical methods to control woody plants, such as willows, salt cedar, mesquite, poison oak, poison ivy, ribes, and cottonwood are being replaced by less expensive chemical methods. The chemicals, 2,4-D and 2,4,5-T effectively control these and other woody plants.

If woody plants trouble you, get rid of them. Follow Weedy's instructions in the cartoon be Do the job right. Select the proper chemical. the right concentration for the weed killer s tion. Be sure the chemical and the concentra are suitable for your problem.

Use the chart on the opposite page. It will you make the solution you need. First prepar solution. Next drench the leaves with it. Yo not have to calibrate the rig for spraying w plants. But when short growing annual and ennial weeds are sprayed, calibration is need put a given poundage of chemical on each (See parts 4, 5, and 6 of this series for method of preparing solutions for this typ application.)

Remember—control of woody plants costs if you treat when the plants are small.

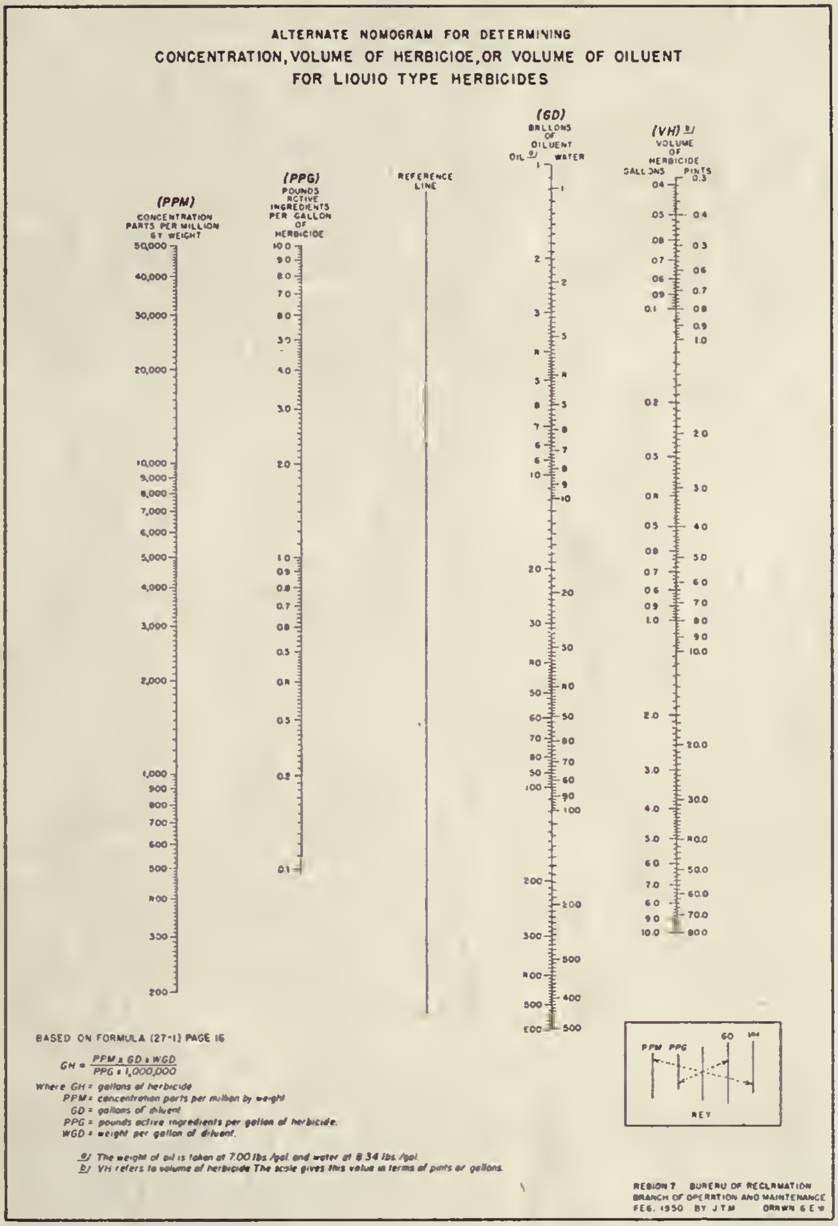


INSTRUCTIONS AND EXAMPLES

se this chart to solve your weed killer ng problem when you go after woody ts with liquid chemicals. The key in lower right-hand corner shows how se the chart. Connect the scales with ansparent straightedge. Note that GD scale is graduated for both water oil. The VH scale gives the answer allons or pints.

ESQUITE. For the control of mesquite praying freshly cut stumps, a solution aining 10,000 p. p. m. 2,4,5-T acid diesel oil is recommended. If the duct to be used is a 2,4,5-T ester con-ng 3.34 pounds 2,4,5-T acid per on—how much should be added to gallons of oil to get the needed con-ration? Connect 3.34 PPG with 10 ons of oil on GD. Mark the point re straightedge crosses reference line. nect point with 10,000 p. p. m. Read ver: 1.7 pints or 0.21 gallons on VH e.

VILLOWS. To control willows, a solu- containing 2,000 p. p. m. of 2,4-D was recommended. If a 2,4-D ester aining 3.33 pounds acid per gallon used—how much chemical must be ed with 300 gallons of water to get concentration wanted? Connect 3.33 with 300 gallons of water on GD. k the point where the straightedge ses the reference line. Connect point 2,000 p. p. m. Read answer: 12 s or 1.5 gallons on VH.



Reclamation's Golden Jubilee

(Continued from page 265)

ber that the great growth and ever-expanding worth of Reclamation have come about precisely because its fundamentals did not change. Like our own dams, Reclamation rests upon tested, sound, permanent foundations. If these foundations collapse, the structure they support will not remain intact.

Reclamation had an outstanding year, constructionwise. During the past few months, water gushed for the first time from the world's greatest pumps at Grand Coulee, from the world's second-greatest pumps at Tracy, and from a third tremendous pumping plant at Granby, Colo. These three pumping installations all within 6 weeks began pouring water on developments which will eventually increase by one-half the total acreage irrigated by Reclamation in its previous 50 years of existence.

Within the 1951 fiscal year, 534,893 acres were furnished with new water supplies, bringing our total Reclamation acreage to well over 6 million. Also, 771,000 kilowatts of power capacity were added. On September 14 of this year the last remaining generating unit at the Grand Coulee power plant went on the line, thus increasing the rated capacity of Bureau plants to 4,047,500 kilowatts. The actual capability of the plants, however, considerably exceeds this figure, and aggregate peak output has already passed 4¼ million kilowatts.

Four dams were completed—Bonny, Ceda Bluff, North Coulee, and Dickinson. Three mor giants—Boysen, Canyon Ferry, and Hungr Horse—loomed higher in their canyons. Th Colorado-Big Thompson drew nearer to the fi ishing line, set at 1953. Thanks to the rehabilit tion and betterment program, our irrigati systems were in better shape than at any time sin the end of the war. We have continued to tu projects over to the water users—last year saw t Balmorhea and Mirage Flats projects, the Mi vale District of the Riverton project, and par of the Yuma project thus come of age. Let tho who fear we may invade States' rights with e cessive Federal control take note. Reclamati has and does insist on relinquishing control a turning operations over to the water users.

Reclamation extended its foreign contacts, ad ing its very considerable resources of technic knowledge to the world-wide effort to relieve t people of the globe—including our own—from t burdens caused by the want of millions. Thou we receive many and various benefits from th foreign activities, both directly and indirect none of the costs are charged to the domestic Re lamation program, or are taken from the Reclam tion appropriations. These are paid by the forei governments concerned or by American foreig assistance agencies, which more and more are co ing to realize that American Reclamation is o of the most productive, most famous, and most w come forms of aid at their disposal. We supp our approved international program, but we do

RECLAMATION GOES GLOBAL is the subject of a meeting of U. S. and South American officials in Ecuador's Capitol. From the left are U. S. Ambassador Paul C. Daniels; Ecuadoran Minister of Public Works, Atahulpa Ruiz; President Galo Plaza of Ecuador and U. S. Commissioner of Reclamation Michael W. Straus. As part of the American Technical Aid program overseas in which demands for irrigation advice are giving Reclamation a leading role, William H. Farmer of the Bureau's Yakima, Washing staff has been making a survey of water developments fo State Department in Ecuador. President Plaza has taken a sonal interest in the program and discussed it with Commiss Straus who stopped at Quito en route to lecture before South American officials at the United Nations F. A. O. American Center Conference in Santiago, Chile, in Naver it Reclamation skills and know-how to become rize for export only. It will not, while we do divert any of our domestic appropriations to rseas endeavor. Furthermore, the technical experience gained from overseas jobs will help us do tter job at home.

ut as Reclamation has moved ahead, so have years, and so have western needs. Viewing this ual report to you from a longer perspective, see that there is one more fundamental fact ut our movement which has not changed—the lamation program still is not meeting the nands for water or power in a single one of the Western States in which it operates.

Our population continues to increase at the rate 2,000,000 a year, authorizations or no authorizans. We have not been able to fill the generator s in our power plants fast enough to keep up h power needs. Now we are running out of s, and it takes years to build new ones. These ds for water and power extend all over the st. And Reclamation is ready and able to proe water and power wherever possible under lamation law, once the authorizations and appriations are available.

During this defense emergency we must be contly alert for new problems affecting Reclama. The distinct outlines of what could become articularly critical one are already on the hori. Hungry industrial and commercial conners of electrical energy desire Reclamation pull the switches on irrigation pumps and forego tering the land as a result of the growing shorte of power. We have already feinted off one ort to divert power from the pumping of irriion water for the Columbia Basin project, and expect others elsewhere. Power for Reclaman pumping means production of more food and er for defense—resources indispensable to the fense mobilization program. Furthermore, Recnation laws are very specific that irrigation has t call on the power generated at Reclamation ns. Some people don't know that, but the type that page of law is large enough for your mmissioner to read without his bifocals.

Our cause is one which can build farm comnities and cities and send trade to the far cors of the earth. The West is full of living, riving proofs of its creative worth. But there e still many western communities where Recnation has not yet brought the water and power r life and growth and true national strength. Whole regions still await the touch of the magic wand of Reclamation to awaken them from an age-old sleep so they, too, can contribute to the production and defense of our country. THE END.

First International Science-Service Agreement Signed

Secretary of the Interior Oscar L. Chapman on October 2 announced the signing of an agreement between the Governments of India and the United States whereby the Bureau of Reclamation will furnish advice and scientific and technical engineering service to the Government of India. This assistance will be given to the Indian Government in the United States only and will be paid for by India in advance of its actual performance.

A. N. Khosla, India's Chairman of the Water and Power Commission, conferred with Secretary Chapman and Reclamation Commissioner Straus on the operations under the agreement, which was completed with the aid and advice of the Department of State.

Under the arrangement Reclamation personnel and laboratory facilities at the Denver Federal Engineering Center will be available to assist the Indian Government with water development problems. The services will include the study and analysis of technical scientific data, testing material for dams, analyses of stresses and stability, and construction and testing of hydraulic models.

Service will be extended to the Indian Government only when it does not interfere with the domestic Federal multipurpose water conservation program in the United States. •

Feeding Salt to Livestock

(Continued from page 269)

feeding value occurs largely as a result of the great decrease in protein and phosphorus accompanied by a marked reduction in the volume of palatable and nutritious forage.

Thus it is that cottonseed meal with its high protein and phosphorus content has served to supplement dry weathered grass and browse. Mixed in from 2 to 4 parts of meal to 1 of salt, depending upon the amount of meal needed, and made accessible for regular dairy consumption, it at least provides sustaining nourishment.

There is no need to restrict the supplement to cottonseed meal alone. Under poor dry-range conditions it is believed that the rumen contents are lacking in the necessary nutrients for fermentation processes to function normally, and the welfare of the animal becomes impaired. This condition is being approached with apparent beneficial results by incorporating alfalfa meal and grain with the salt and meal. Molasses and trace minerals can be introduced if desired and the facilities permit. According to conjecture, the addition of these nourishing feeds in varying proportions to replace a part of the cottonseed meal stimulates the micro-organism activity of the rumen and makes for more efficient use of the available range feed.

Salt consumed in excess amounts can be fatal to livestock. Fortunately, in this regard cattle are highly tolerant to above normal levels of salt intake. Considerable speculation concerning the subsequent effect on the animal of continued digestion of excess salt led to a study of this problem by the University of Arizona. Tests revealed that cows digested (the technical term is "ingested") 1 pound of salt daily on a maintenance ration throughout 7 months of a pregnancy cycle without adverse effects. It was found that high salt intake must be accompanied with a corresponding increase of water consumption. A relatively small amount of salt can be fatal if water is restricted. It is not unlikely that this unnatural use of salt could be attended with adverse effects under certain conditions that have not as yet been investigated.

Care should be taken to avoid changing cattle suddenly from a straight feed supplement to a salt-feed mixture. Very hungry cattle may overeat at first if their supply is not regulated.

Salt-feed mixtures containing 33⅓ percent loose and pellet form are widely fed in the ran country. Stockmen can mix combinations their own choice or rely on commercially pr pared mixtures. Local range or pasture cond tions will necessarily determine the particul mixture to feed.

A 30 to 33⅓ percent salt content is about t maximum amount to produce the right inhibiti effect and still allow sufficient intake of the fe portion. Reduction of the salt level from 33 to 25 percent has effected an increase of prac cally 50 percent consumption in some range are according to reliable reports.

Self-feeding with salt as the control age recommends this practice for making a grain mixed feed concentrate available to pasture catt The desired daily consumption may be automat ally fixed by adjusting the salt level.

Covered self-feeder containers with trough i sert attachment, portable, and of 1,000- to 1,5 pound capacity are in rather common use. (D tailed plans for this type of feeder are availa from the University of Arizona Agricultural E tension Service, Tucson.) Open troughs are l expensive though the feed may spoil and bl away.

A committee on animal nutrition of the N tional Research Council made this significa statement: "Data demonstrate that if a grea proportion of the concentrate feeds now availa for beef cattle in the United States were used the earlier stages of production to alleviate qu tative and quantitative deficiencies of range p ture, and wintering rations, these feeds would utilized more effectively, continuous growth a development would be promoted, and a sign cantly greater tonnage of better-quality b would result."

Arizona cattlemen, by demonstrating the ef tive use of salt for making nutritionally balan feeds readily available to range stock, have m it possible to promote the continuous growth young stock and achieve a more efficient use range and pasture feed. THE E

Yuma Mesa Units To Be Opened for En

Twenty-seven public land farm units in Yuma Mesa Division of the Gila project in A zona south and east of Yuma, will be opened settlement late in December 1951. This is nd opening in this area. All applications will onsidered as having been simultaneously filed ided they are received within 3 months of the ing date.

eterans of the Spanish-American and World I, and those who served at least 90 days in Army, Navy, Marines, Coast Guard, or Air e on or after September 20, 1940, and were orably discharged have preference in filing for e units. Settlers must have had at least 2 s' farming experience and assets worth at least 00 in excess of liabilities. These assets must ash, property readily convertible into cash, or stock, farm machinery and equipment, which be useful in the development and operation new irrigated farm.

he 27 farms consist of 4,051 acres and range ize from 116 acres to 160. The average size is approximately 150 acres. For information applications write to the District Manager, er Colorado River District, Bureau of Recation, Yuma, Ariz. •

Columbia Basin Farms for Sale

pplications for purchase of 39 Columbia Basin ject full-time farms located in Grant County, sh., the central part of the project, will be ilable during December 1951. Prices range n $589.40 to $3,362.50 depending on the size he farm and the class of land.

he farms which comprise 2,760.4 acres average acres and range in size from 38 to 103 irrigable es. Veterans of World War II, and all who e served in the Army, Navy, Marine Corps, Air ce, and Coast Guard since September 20, 1940, a minimum period of 90 days and were honory discharged, will be given preference in buying se farms. The closing date for filing applicans is 90 days after the opening.

Applicants must have had at least 2 years farm experience and assets worth at least $4,500 in ess of liabilities. Assets must be cash, property dily convertible into cash, or property such as estock, farm machinery and equipment which uld be useful in the development and operation a new irrigated farm. Inquiries, and requests applications should be forwarded to the lumbia River Basin District Office, Bureau Reclamation, P. O. Box 368, Ephrata, ash. •

Relief for Middle Rio Grande Valley

Water users in the Middle Rio Grande Valley in New Mexico, who have been plagued by drought while at the same time salt cedar and other vegetation in the Rio Grande channel, plus evaporation from ponds and lagoons have been draining away an estimated 140,000 acre-feet of water each year, received a two-way relief program late in September. Secretary of the Interior Oscar L. Chapman announced a construction contract award for improving a 21-mile stretch of the Rio Grande, and placed the Government's seal of approval on an agreement with the Middle Rio Grande Conservancy District providing for repairs and extension of its irrigation and drainage system.

The double-barreled program is the first step in a comprehensive plan assigned to the Bureau of Reclamation by agreement of the Secretary of the Interior and the Secretary of the Army, to bring the Middle Rio Grande Valley up to its maximum production potential. The District's existing system was constructed to serve 118,000 acres of land, but only about 79,700 acres, including Indian lands, are irrigated at the present time. According to the plan an additional 5,200 acres will be placed under irrigation.

The Middle Rio Grande Conservancy District contracted to repay $18,000,000 to the Government within 40 years for repairing and extending its irrigation and drainage system, including the repair of El Vado Dam and reservoir. •

Andrew Weiss Dies

Andrew Weiss, internationally known consulting engineer and expert on irrigation, died Sunday, September 7, 1951, in Mexico City, his home since 1926. Burial services were held there Monday, and memorial services were held the following Saturday at Denver, Colo., under the sponsorship of the Colorado School of Mines Alumni Association.

Mr. Weiss, who was 84 at the time of his death, was former assistant director of reclamation economics, and joined the Reclamation Service in 1903. He served as assistant engineer and later as project manager on the North Platte project in Nebraska and Wyoming and the Salt River project in Arizona. In 1949 he was made an honorary member of the American Society of Civil Engineers (see page 56, March 1949 issue of the Reclamation Era). •

CROPS

Strawberries Are Tops in Value

Farmers on the Salt River project in Arizona received almost $2,500 per acre for strawberries grown during 1950 according to the Bureau's latest crop report. The total crop on the project, weighing 3,500,000 pounds, was raised on 312 acres. The gross value amounted to $772,200. The per acre value of $2,475 was more than four times greater than apples, the next highest fruit crop grown on reclamation projects, which carried an average value of $539 per acre.

The Salt River berries are among the "first fruits" of the season, reaching markets in the United States far in advance of the regular strawberry crop, thus making them strictly noncompetitive.

In 1949 Salt River project farmers raised 2,016,000 pounds of strawberries, on 252 acres (60 acres less than in 1950) with a total value of $604,800 or $2,400 per acre. Despite the fact that the 1950 berries sold for 8 cents less than in 1949, the total per acre value received in 1950 was $75 more. Additional underground water installations, which provided better water supplies permitted the addition of 60 acres to cultivation. ●

The Era hereby extends an open invitation to Salt River project farmers to send in photos and more information about this successful crop. We believe our readers would be interested in knowing how they did it—what variety of plants was used, how they were irrigated, cultivated, harvested and marketed, plus any data regarding the capital investment necessary and an idea of the net profit resulting from such an undertaking.

We offer the same invitation to other farmers on reclamation projects to swap money-making ideas for irrigation farmers. Everyone likes to read success stories, and most everyone likes to tell his neighbors about a good crop, thriving livestock, farm improvements, and community activities. A free subscription to the Reclamation Era for 1 year is awarded to anyone whose material is published in the Bureau's official publication.

LETTERS

Sixth Army Likes "Short Cuts"

John T. Maletic, author of the current series of articles entitled, "Short Cuts to Weed Killing Calculations," received the following letter from the Headquarters of the Sixth Army, Presideo of San Francisco, Calif.

We are preparing a manual for the guidance and direction of the post engineers' weed-control program at Sixth Army installations. In this connection we have read with interest a portion of your article on "Short Cuts to Weed Killing Calculations." You are to be congratulated on your excellent presentation of this material.

The commanding general has directed me to request you to furnish us with a copy of the complete series and illustrations of this series of articles. Any other material that you have along the lines of weed killing operations that you feel would be of aid to us in preparing this manual will be welcomed.

Sincerely yours,

J. G. Dumbolten,
2d Lt. AGC,
Asst. Adj. General.

Have you a good idea on a short cut or labor-saving device to share with other water users on Reclamation projects? Send it in to your nearest Bureau of Reclamation office or to the Editor, Reclamation Era, Bureau of Reclamation, Washington 25, D. C. The writing does not have to be fancy. Just make certain you have the answers to Who, What, Where, When, Why, and How in your story. As for pictures, a rough sketch or snapshot would serve our purposes. Remember, this is the only official publication of the Bureau of Reclamation, the only periodical devoted entirely to the interests of water users on projects served with facilities made available by the Bureau. It is your magazine, and will be as good as you can make it. By helping others you will also help yourself. Send your item in today.

How To Do It

Here is a letter from W. G. Waggoner, of our Region 2 office in California. We agree wholeheartedly with his suggestion and hope our readers will flood us with their contributions for this new feature. We have asked for material like this continually, an[d oc]casionally receive gems lik[e the] one we worked out from Myer's letter and snapshot, w[hich] evolved as the article enti[tled] "Cover your Siphons" on page Let's have more of the[se]. Start the ball rolling with an from somebody on your pr[oject] and keep the short cuts or ideas coming in.

I suggest that a section of the E[ra be en]titled along one of the following li[nes]:

Short Cuts by Water User[s]
Labor Saving Ideas Among Water Users.
Good Ideas From the W[ater] Users.
Passed Along by the W[ater] Users, or
How To Do It Ideas From Water Users.

The articles in this section shou[ld be] short and to the point, illustrated [by] photograph, and written with only one purpose of imparting immed[iately] usable information to the far[mer]: something he can do on his far[m]; cheaper way to paint his barn; b[uild a] chicken coop; start his tractor in w[inter] time; make a new door catch; a d[...]sing hog feeder; stretch wire fence, written in the style of the Po[pular] Science magazines.

I remember when I was a kid o[n the] farm our entire library consisted o[f the] family Bible, the weekly newsp[aper], Popular Mechanics, and the Sears[-Roe]buck catalog. My mother read Bible, the newspaper went to start Popular Mechanics was worn dog-[eared] each month looking for ideas we apply on the farm, and we all use[d the] catalog. The popular science [maga]zines mostly owe their popularity [to the] fact that they are a kind of na[tional] suggestion box, containing do[wn-to-]earth usable ideas.

The best and most logical sour[ce of] this article material is the farm[ers on] Bureau operating projects. As [an oc]cupational group I believe farme[rs are] the most resourceful and inve[ntive]. Their activities are so varied, th[ey are] usually remote to a ready source [of spe]cialized skills, that they must co[ntinu]ally improvise practical answe[rs to] their problems.

As an operating means for init[iating] and sustaining this water users s[ection] of Reclamation Era, one project [could] be covered for each issue. Burea[u]

with the assistance of water
ficials could ferret out the short
d on the particular project fea-
nd write them up for the ERA.
s added feature I think we could
publication of vast interest to
er users.

OREIGN ACTIVITIES

Bureau of Reclamation's assist-
constantly being sought by many
nations whose problems in deal-
h irrigation, power, potential
tes, water resources, etc., are
ith which the Bureau is familiar
niquely capable of resolving.
equests for technical assistance
he Bureau through the Depart-
f State, the Economic Coopera-
ministration, the Department of
ny, the Department of the Navy,
er Federal agencies.

echnical cooperation activities of
eau involve 18 reclamation tech-
in 13 foreign countries. The
training program includes 30
from 11 countries, the number
edited foreign visitors average
month and the publications are
ent abroad at the rate of 6,000
r. This assistance is performed
t any cost to the Bureau. Here
ne of the Bureau's current for-
tivities:

E.—Reclamation Commissioner
l W. Straus is delivering a series
ures on reclamation administra-
ocedures in Santiago under the
s of the Latin American Train-
ter of the Food and Agricultural
zation of the United Nations.
rpose of this meeting is to discuss
nd projects for agricultural and
lectric development in Latin
a.

ADOR.—William H. Farmer, irri-
engineer, has been assigned to
gate and study the feasibility of
ion developments on the Santa
Peninsula in cooperation with
nistry of Public Works.

MOSA.—T. R. Smith is making a
of the over-all water conserva-
acilities in terms of present and
needs for the improvement,
tion and expansion of present
ies, and will recommend what
be done and how it should be

GREECE.—Harold E. Miller, hydraulic engineer, is advising on the construction of two multiple purpose projects involving flood control, irrigation, and power.

INDIA.—Hugo Marek, Jr., is acting as technical adviser to that Government on foundation explorations and treatment at Indian dam sites, particularly construction of the Kakrapar Dam in the State of Bombay and the Hirakud Dam in the State of Orissa.

LIBERIA.—Robert R. Williams is working directly in the Water Control Division of the Department of Public Works, planning and directing investigations of hydroelectric power potentialities, including preliminary investigations of power potentialities.

MALAYA.—Edward R. Dexter, civil engineer, and William H. Irwin, assistant chief geologist, are advising on the construction of an impounding dam at the Klang Gates near Kuala Lumpur, capital of the Federation of Malaya. The peculiar problems present at the Klang Gates are similar to those of a great number of American dams which have been built on more or less fissured bedrock.

SAUDI ARABIA.—C. William Burningham and Thomas R. Smallwood are advising that Government on hydrology, basic surveys for land and water development, the designing of irrigation systems, including storage dams, weirs, and other diversion structures, water-spreading works for ground water storage, pumping plants and community distribution systems.

THAILAND.—August L. Ahlf and Mauric E. Day are advising that Government on canal designs for the Chao Phya and other irrigation projects.

A few of the qualified engineers from foreign countries who are taking in-service training at the Denver laboratories are: Michel Guessard, FRANCE; Barry Rydz and E. Drummond Taylor, GREAT BRITAIN; Yadurai Kaul, INDIA; Tahsin Bakr, Abdul Kaddou, and Najib Kassab, IRAQ; Abba Tor, ISRAEL; Giuseppe Barbero, ITALY; Mohammed Badruddin, PAKISTAN; Dennis Standish-White, SOUTHERN RHODESIA; Sathien Bhadrasiri, Chien Bhumisawasdi, Ananda Indrathorngmon, M. L. P. Malakul, Udom Panyaphol, Chalaw Hunranaphan, Om Dibbabadya, Tamon Kandhasingha, Boonthai Otaganonta, Bhochana Panyadhibya, Bachong Pisalbutra, Amphan Poonagunta, Udom Rakchanya, Sara Subharngkasen, Vira Suttipongse, THAILAND; M. S. Canakin, Ali G. Mutdogan, Kemal Noyan, Osman C. Ugur, TURKEY: and Rafael de Los Rios, Jóse R. Grillet, Manual Lanz, Alejandro Rengel, VENEZUELA.

RELEASES

Missouri River Basin Topographic Maps Available

Several new topographic maps, essential to the progressive development of the Missouri River Basin, have been recently published by the Geological Survey, presenting a symbolized picture of the natural and man-made features existing upon the land surface. They portray drainage and the general configuration of the land in any particular area, and delineate the roads, railroads, dwellings, lakes, rivers and streams, etc. The latest maps in the series, needed as the background for planning the Department's Missouri River Basin program, and prepared to meet the urgent requirements of the two construction agencies, the Bureau of Reclamation and the Corps of Engineers, are as follows: Hudson, Colo.; Milliken, Colo.; Cascade, Mont.; Norris, Mont.; Cottonwood Falls, Wyo.; the Reefs, Wyo.; Guernsey Reservoir, Wyo.; Mexican Pass SE., Wyo.; Moon Lake, Nebr.; Turpin Lake, Nebr.; Wolf Lake, Nebr.; Camp Grafton, N. Dak.; Harvey, N. Dak.; Oberon, N. Dak.; Crow Hill, N. Dak.; Westhope, N. Dak.; Big Falls, Nebr.; Brownlee, Nebr.; Bull Lake, Nebr.; Long Lake, Nebr.; Grand Harbor, N. Dak.; Polo, S. Dak.; Rezac Lake, S. Dak.; Rice Lake, S. Dak.; and Grantville, Kans.

The maps vary in size and price. Inquiries should be sent to the Director, Geologic Survey, United States Department of the Interior, Washington 25, D. C.

NOTES FOR CONTRACTORS

Contracts Awarded During October 1951

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address
DS-3451	Colorado-Big Thompson, Colo.	Oct. 4	2 5,000 horsepower at 300 revolutions per minute vertical-shaft synchronous motors for Willow Creek pumping plant.	Electric Products Co., Cleveland, Ohio.
DS-3473	Boise, Idaho	Oct. 11	2 switchgear assemblies for Anderson Ranch power plant, Item 1.	Westinghouse Electric Corp., Denver, Colo.
DS-3480	Central Valley, Calif	Oct. 19	9 motor control and 9 distribution switchboards, 2 motor starters, and 1 distribution cabinet for pumping plants S-4 to S-10, inclusive, and S-12, S-13, and S-14, in laterals 124.5E, 127.7E, and 130.4E, Unit 3, Southern San Joaquin Municipal Utility District, Friant-Kern Canal distribution system, schedules 1 and 2.	General Electric Supply Corp., Denver, Colo.
DC-3482	Cachuma, Calif	Oct. 29	Construction of Glen Anne Dam, pts. A and B	L. A. and R. S. Crow, El Monte, Calif.
DS-3492	Boise, Idaho	Oct. 10	One 2,000-kilovolt-ampere transformer with 3 23,000-volt lightning arresters for Prairie Power Cooperative substation, schedule 1.	Erie Electric Co., Inc., Buffalo, N. Y.
DS-3511	Central Valley, Calif	Oct. 11	3 15-foot 6-inch diameter steel penstocks for Folsom power plant.	Southwest Welding & Manufacturing Co., Alhambra, Calif.
DS-3512	Colorado-Big Thompson, Colo.	Oct. 5	1 combination welded-plate-steel discharge pipe for pump discharge line for Willow Creek pumping plant.	Eaton Metal Products Co., Denver, Colo.
DS-3513	do	Oct. 12	3 14,000-volt circuit breakers, 6 40-kilovolt-amperes current-limiting reactors, and 6 potential transformers for Flatiron power and pumping plant switchyard and Pole Hill power plant switchyard, schedules 1, 3, 4, and 5.	General Electric Co., Denver, Colo.
DC-3514	Columbia Basin, Wash	Oct. 19	Construction of Babcock pumping plant and lateral W35.9, area W-8, West canal laterals.	Collins Concrete & Steel Pipe Co., Portland, Oreg.
DS-3519	Missouri River Basin, Mont	Oct. 16	5 115,000-volt circuit breakers for Canyon Ferry switchyard, schedule 1.	General Electric Co., Denver, Colo.
DS-3519	do	do	4 115,000-volt selector-type switches and two 115,000-volt disconnecting switches for Canyon Ferry switchyard, schedule 2.	USCO Power Equipment Corp., Birmingham, Ala.
DS-3519	do	do	7 current and 4 potential transformers for Canyon Ferry switchyard, schedule 3.	Westinghouse Electric Corp., Denver, Colo.
DC-3524	Missouri River Basin, Nebr.-Kans.	Oct. 31	Construction of Franklin South Side pumping plant, canal, laterals, sublaterals, and drains.	Rentlor Co., Inc., Grand Island, Nebr.
DC-3528	Columbia Basin, Wash	Oct. 25	Construction of earthwork, lateral lining, pipe lines, and structures for Area P-1 laterals and sublaterals, Potholes East canal laterals, schedule 1.	Long Construction Co., Inc., Billings, Mont.
DS-3529	do	Oct. 19	2 1,500-kilovolt-ampere, 1 500-kilovolt-ampere, and 2 300-kilovolt-ampere transformers for Lower and Upper Scooteney, Lower Saddle Gap, Upper Scooteney Relift, and PE-17 pumping plant switchyards, schedules 1, 2, and 3.	Gough Industries, Inc., Los Angeles, Calif.
DC-3530	do	Oct. 2	Construction of earthwork, pipe lines, and structures for area W-5 laterals, sublaterals, wasteways, and drains, West canal laterals and West canal protective works, schedule 1.	Cherf Bros. Construction Co. and Sandkay Contractors, Inc., Ephrata, Wash.
DS-3531	Cachuma, Calif	Oct. 11	1 36-inch diameter tube valve with floor-stand control for regulating works on Tecolote tunnel.	Northwest Marine Iron Works, Portland, Oreg.
DC-3538	Columbia Basin, Wash	Oct. 24	Construction of earthwork, pipe lines, and structures for Area P-2 laterals, sublaterals, and wasteways, Potholes East canal.	Intermountain Plumbing Co., Inc., and Henry L. Horn, Moses Lake, Wash.
DS-3539	Hungry Horse, Mont	Oct. 19	2 control valves, 1 control stand, and 1 lot of control connections for spillway ring gate at Hungry Horse Dam.	Northwest Marine Iron Works, Portland, Oreg.
117C-116	Columbia Basin, Wash	Oct. 24	Drilling water supply wells at O&M sites for areas E-2, E-3, P-1, and P-2 ditchriders residences, schedules 1, 4, 6, and 7.	Frank L. Zimmerman, Moses Lake, Wash.
117C-116	do	Oct. 23	Drilling water supply wells at O&M sites for areas E-2, E-3, P-1, and P-2 ditchriders residences, schedules 2, 3, and 5.	Ralph Cassell, Yakima, Wash
117C-116	do	Oct. 19	Drilling water supply wells at O&M sites for areas E-2, E-3, P-1, and P-2 ditchriders residences, schedule 8.	Courtney Bach, Union Gap, Wash.
100C-135	Lewiston Orchards, Idaho	Oct. 16	Construction of operator's house at water treatment plant	Taschereau Construction Co., Spokane, Wash.
117C-118	Columbia Basin, Wash	Oct. 11	Constructing timber bridge at West Canal, station 1807+77.29.	Allied Construction Co., Ephrata, Wash.
117C-122	do	Oct. 24	Gaging stations, Main, East Low, Potholes, West Canals, Winchester, Rocky Coulee, and Weber wasteways.	Harold Kaeser, Seattle, Wash
200C-176	Central Valley, Calif	Oct. 26	Line maintenance building at Orland, Calif	Modern Building Co., Chico, Calif.
300C-29	Davis Dam, Ariz	Oct. 31	Construction of Cochise substation	Hufford & Kyger Construction Co., Kansas City, Mo.
601C-18	Riverton, Wyo	Oct. 10	Access roads and bridges across Five Mile and Muddy Creeks	Sharrock and Pursel, Casper, Wyo
617C-22	do	Oct. 23	Asphaltic lining for Wyoming Canal and laterals	Studor Construction Co., Billings, Mont.
617C-23	do	Oct. 31	Application of asphalt membrane lining, Pilot canal and laterals.	Blacktop Construction Co., Billings, Mont.

Construction and Materials for Which Bids Will Be Requested by February 1952

Project	Description of work or material
Boulder Canyon, Ariz.-Calif.	Construction of 5.4 miles of 12- to 42-inch diameter concrete pipelines for unit 9, part II of the Coachella Valley distribution system near Coachella, Calif., All-American canal system.
Buffalo Rapids, Mont	Additions and improvements to pumping plants and canal structures for Shirley and Terry units and channel relocation and wasteway structures for Fallon unit.
Cachuma, Calif	Construction of 18- by 65-foot Lauro chlorination and control house near Santa Barbara, Calif. Installation of about 15 36-inch diameter valves and 1,500 feet of 54-inch diameter steel pipe, venturi meters, and other equipment for chlorination of 55 cubic feet per second of water for domestic purposes.
Do	Construction of 16 miles of concrete pipe conduit varying in size from 36- to 27-inch diameter, and 3 control stations, part of the Carpinteria section of South Coast conduit near Santa Barbara, Calif.
Central Valley, Calif	Construction of ditch riders' houses at Newman and San Luis wasteways on Delta-Mendota Canal near Newman, Calif.
Central Valley, Calif	Construction of 160,000-kilowatt Folsom pow[er plant] near Folsom, Calif. This semioutdoor ty[pe] will require construction of a reinforced [concrete] structure about 120 by 240 feet and 107 [...] and installation of 3 74,000-horsepower [...] a 300-ton gantry crane, and other eq[uipment] 3 15.5-foot diameter, 200-foot long Gov[ernment-]furnished penstocks are to be embedded [in con]crete-lined rock tunnels. Additional ex[cavation] required for the power plant and tailrace will be about 85 percent in rock.
Do	Construction of 43 miles of pipelines for Ex[eter Irri]gation district on the Friant-Kern Canal [distribu]tion system, near Exeter, Calif. Contrac[tor to] furnish the 12- to 42-inch diameter pipe w[ith heads] up to 75 feet. Work also includes constr[uction of] monolithic concrete moss screen and [pumping] plant structures, installation of moss screen[ing] units, valves, slide and flap gates, and [furnish]ing and installing electrical controls.

U. S. GOVERNMENT PRINTING OFFICE: 195[1]

Construction and Materials for Which Bids Will Be Requested by February 1952—Continued

roject	Description of work or material
alley, Calif.	3 230-kilovolt 800-ampere and 1 69-kilovolt 1,200-ampere outdoor power circuit breakers and 7 230-kilovolt and 5 69-kilovolt disconnecting switches for Folsom switchyard.
	3 horizontal-shaft centrifugal-type motor-driven pump ing units and 6 vertical-shaft propeller-type motor-driven pumping units of 2 to 4 cubic feet per second capacities for pumping plants E1 to E5; and 3 vertical-shaft turbine-type moss screen pumps, each 360 gallons per minute, for Exeter irrigation district No. 2, Friant-Kern canal distribution systems.
Big Thompson,	Installation of 2 48-000-horsepower turbines, governors, pump turbine, and a 13-000-horsepower generator-motor unit, transformers, circuit breakers, and switchyard equipment, and completion of building interior for the 80-000 kilovolt-ampere Flatiron power plant; and installation of 1 47,500-horsepower turbine, governor, transformers, circuit breakers, and switchyard equipment, and completion of building interior for the 35-000-kilovolt-ampere Pole Hill power plant.
Basin, Wash.	Completion of electrical installations in industrial area, machine shop, and warehouses A and B, including electrical wiring for underground distribution system in industrial area and removing existing overhead distribution system; removal of existing heating plant; installation of substation for caisson drydock and installation of feeder canal gaging equipment, at Grand Coulee Dam.
	Placing terrazzo in Grand Coulee right power plant, pumping plant, and machine shop.
	Construction of streets, sidewalks and curbs; sewer and water lines; grading lots and parking areas; paving streets; installation of street lighting, and removal of miscellaneous buildings in town of Coulee Dam, Wash.
	Construction of 20 miles of unlined laterals and wasteways of 180 to 2 cubic feet per second capacities, to irrigate about 6,000 acres in lateral area P–3 on Potholes East canal, northwest of Mesa, Wash.
	Construction of 6 miles of 30 cubic feet per second capacity lined channel, 6 miles of 60 cubic feet per second capacity unlined channel, and 9 culverts for interception and conveyance of excess ground water in the vicinity of Soap Lake, Wash.
	Construction of 48 miles of unlined laterals and wasteways of 119 to 2 cubic feet per second capacities to irrigate about 18,000 acres in lateral area E–4 on East Low canal, north of Warden, Wash.

Project	Description of work or material
Davis Dam, Ariz-Nev.	Erecting steel structures and installing electrical equipment for 13.8-kilovolt installation at Tucson substation.
Do	Erecting steel structures and installation of electrical equipment for 69-kilovolt switchyard and transformer circuits at Davis Dam, Ariz.
Deschutes, Oreg.	Lining North Unit canal with pneumatically applied mortar between Bend, Oreg., and 24 miles northeast of Bend.
Eklutna, Alaska	Steel penstock for Eklutna power plant, 1,400 feet in length, and 72, 78, and 84 inches in diameter.
Do	2 vertical, gate-shaft type, 50,000 foot-pound capacity governors for 24,000-horsepower hydraulic turbines at Eklutna power plant.
Fort Peck, Mont.-N. Dak.	Construction of 115/12.47-kilovolt Dawson substation at Glendive, Mont., involving erecting steel structures, installing major electrical equipment, and furnishing and installing all other equipment, and construction of operation and maintenance and service buildings.
Gila, Ariz.	Construction of 28 miles of unreinforced concrete-lined Mohawk laterals and sublaterals of 120 to 15 cubic feet per second capacities, and appurtenant reinforced concrete structures, and removal of existing timber and concrete structures, for unit 1 near Roll, Ariz.
Kendrick, Wyo.	Installation of armor rods and vibration dampers and changing overhead ground wire connections on 22 miles of 115-kilovolt transmission line between Gering and Alliance, Nebr., and Gering and Casper, Wyo.
Middle Rio Grande, N. Mex.	Construction of channel headquarter buildings at San Marcial, N. Mex., about 20 miles south of San Antonio, N. Mex. Included are a 3-bedroom, 34- by 42-foot concrete block dwelling, a 40- by 100-foot office, warehouse, and shop building of prefabricated steel, and 12- by 18-foot prefabricated steel storage building, a 10- by 12-foot concrete block pump house, and utilities.
Do	Construction of 17 miles of Rio Grande River drainage and conveyance channel and levee from San Marcial, N. Mex., to channel headworks.
Missouri River Basin, Nebr.	Removing a portion of consumers' public power district diversion dam, removing 2 bridges, and excavating for extension of Lost Creek channel at Superior, Nebr.
Missouri River Basin, Wyo.	Supervisory control and telemetering equipment for controlling Lovell and Thermopolis substations from Boysen power plant.
Shoshone, Wyo.	Lining 3 miles of Heart Mountain Canal.

United States Department of the Interior

Oscar L. Chapman, Secretary

BUREAU OF RECLAMATION OFFICES

Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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REGION 1: Harold T. Nelson, Regional Director, Box 937, Reclamation Building, Fairgrounds, Boise, Idaho.
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REGION 7: Avery A. Batson, Regional Director, 318 New Customhouse, Denver, Colo.

THE RECLAMATION AREA

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The Reclamation ERA

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CONTENTS

FEATURE ARTICLES

SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1.50 a year for persons residing in the United States and Canada; $2 a year for foreign subscriptions; special rate of $1 a year for members of water users' associations, and Bureau of Reclamation employees.

OUR FRONT COVER

The second largest water hole in the Pacific Northwest began to take shape last September 21 when steel stop logs were dropped into a 12-yard-diameter diversion tunnel to block the flow of the South Fork of the Flathead River near Kalispell, Mont., creating Hungry Horse Reservoir, in back of the Hungry Horse Dam. It will be exceeded in capacity only by the F. D. Roosevelt Lake in Washington. When full the lake will be 3½ miles wide, 34 miles long, and 500 feet deep at its deepest point. Hungry Horse Dam, key feature of the project, now towers 424 feet in the canyon with 140 feet to go by the end of the 1952 construction season. Photo by A. E. McCloud, Hungry Horse Photographer, Region 1.

35 YEARS AGO IN THE ERA

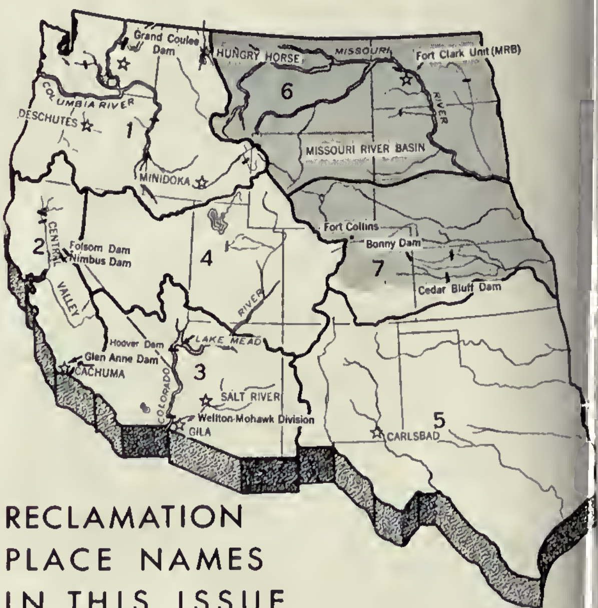
NEW YEAR GREETINGS TO OUR WATER USE

From Arthur P. Davis, Director and Chief Engin

The men and women who by toil, privation, and pe verance are creating homes and communities in the de are adding to the strength and wealth of the Nation, the most effective cooperation to this end is my high ambition. I wish the water users for the coming year great success and increasing prosperity which their he efforts have earned.

(From page 2 of the January 1917 issue of the RECLA TION RECORD, predecessor to the RECLAMATION ERA.)

In 1952—35 years later—Commissioner Michael Straus sends his greetings for a Happy, Prosperous Peaceful New Year to the members of the growing Re mation family, who live not only in the former west deserts of the United States, but in other parts of great country and all over the world.



RECLAMATION PLACE NAMES IN THIS ISSUE

FARMS WILL FLOURISH on land like that at left where Ian Briggs, Maurice Langley (Bureau of Reclamation), and C. O. Stanberry (Bureau of Plant Industry, Soils and Agricultural Engineering) plan a development farm next year. Below, the Gila flood of August 29, 1951, after a dry 10 years. *Photos by Samuel B. Watkins, Region 3 photographer.*

WATER for the WELLTON-MOHAWK

PART ONE—PAST AND PRESENT

y A. B. WEST, Supervisor, Operation and Main- nance Division, Region 3 headquarters, oulder City, Nev.

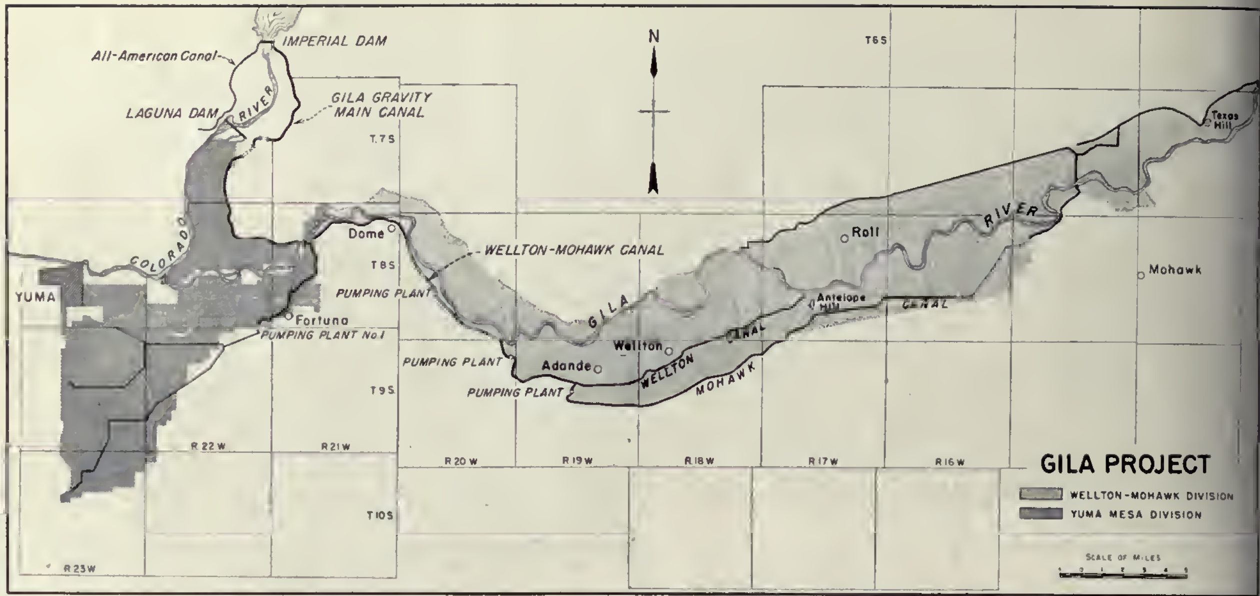
HE WATER WAS GETTING SCARCER every year. And e scarcer it got, the saltier it became. Livestock nd people wouldn't drink it—neither would most lants. Farms went out of production. Those hat were left narrowed their operations to plants hat could subsist on the brackish water.

This describes the situation faced by farmers in outhwestern Arizona's Wellton-Mohawk Valley uring the past decade. Until last summer's loudbursts up and down the river, the Gila had arried no water into the valley since the big flood 1941, and there had been no sweet water to echarge the underground supply and leach the oil. Irrigation from the dams upstream from he Wellton-Mohawk Valley on the Gila and its ributaries and from hundreds of wells has dried p the lower end of the river, which joins the Colorado about 11 miles northeast of Yuma, Ariz.

Except for a few well-kept farms fortunate nough to have usable water, the Wellton-Mohawk Valley presents a lonely scene. There are miles of dried-up ditches with their abandoned concrete box turnouts reminiscent of tombstones. Dead mesquite trees, their roots deserted by the falling water table, add to this oft-repeated drought story of Western agriculture. Where lush fields of alfalfa once thrived, only the hardiest of desert shrubs and weeds remain. White salt deposits, glistening beneath a blistering desert sun, explain all too vividly what has happened.

But only the vegetation is dead on these lands which once were fed with sweeter water. The ditches again will carry water when the Bureau of Reclamation places the Wellton-Mohawk canal system in operation early this year. New lands will be cleared and leveled until within a few years up to 75,000 acres will be in crops, never to be threatened by lack of water or by water too salty for crops or man or beast.

When John C. Fremont visited the area around 1850, on one of his early trips, he reported that the Gila was navigable as far as Antelope Hill, about the middle of the present Wellton-Mohawk development. Establishment of the Butterfield stage line brought the white farmer to the valley in the 1850's, and by 1875 a number of homestead



filings had been made on river bottom lands around the present towns of Wellton and Roll, Ariz. During the eighties, gravity canals were built to irrigate several thousand acres. The fertile lands, enriched by centuries of river alluvial deposits, were highly productive and the farmers prospered. Then came the floods in the fall of 1890 and spring of 1891. Diversion works at Texas Hill near the upper end of the area were washed out and the course of the river moved nearly a mile to the south. The Antelope Valley heading further downstream was destroyed, and 31 miles of the Southern Pacific Railroad were washed out. The great Arizona drought from 1898 to 1904 almost dried up the Gila. In 1905 the river again flooded with resulting damage to irrigation works.

The Antelope Valley Irrigation District, organized in 1906, rebuilt the Antelope canal and constructed a wood-burning steam-electric generating plant at Wellton to pump water from the river into the canal near Antelope Hill. The

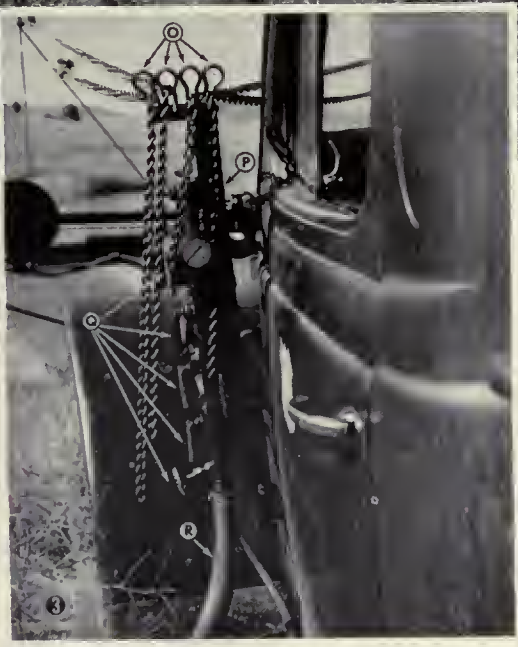
LIFELINES FOR THE WELLTON-MOHAWK VALLEY—The map shows where the ditches again will carry water when the Bureau of Reclamation places the Wellton-Mohawk canal system in operation early this year. New lands will be cleared and leveled until within a few years up to 75,000 acres will be in crops. ***Map by Drafting Section, Washington, D. C.***

transmission line from the plant to the pumps was the first to be built in Yuma County.

The first wells were drilled around 1915 by several of the settlers who believed that wells would provide a cheaper and more reliable source of water than the river. Successful farming during the years that followed resulted in the drilling of more wells. Increased demand for electricity to drive the well pumps led to the formation in 1921 of the Gila Valley power district, encompassing 97,000 acres of land. Organization within the power district of the Mohawk municipal water conservation district followed in 1923, consisting of approximately 18,500 acres. During this period about 50 large irrigation wells were drilled and about 9,000 acres cleared and leveled. By 1928, over 5,000 acres were in crops and in 1931

(Please turn to page 20)

HE NEVER GAVE UP HOPE—R. H. McElhaney homesteaded this farm in 1942 and worked for the project that would save it from failure. ***Photo by Samuel B. Watkins, Region 3 photographer.***



AR VIEW—Just behind the cab is a 200-gallon tank for the ay solution (A). The 25-gpm pump and air-cooled engine are at ver right (B). The 2-inch diameter suction hose (C) for quickly lling the spray tank with water from a ditch can be handled nply by the operator who turns two valves, and the pump either ills the tank or forces the mixed spray solution to the boom line. left, with the spigot over the tail of the truck bed, is a 50-gallon m of concentrated chemicals. ***All photos on this page by Phil rritt, Region 1 photographer.***

DESCHUTES' "WEEDMOBILE"

A HOME-MADE ADJUSTABLE, ADAPTABLE, FREE-HEELING, DRIVER-OPERATED ditchbank weed spray-g machine has joined the artillery against weeds 1 the 50,000 acre North Unit of the Deschutes roject in Oregon.

This new machine was developed by members of efferson County, the Extension Service, the Jef-rson County Seed Growers Association (repre-nting the Deschutes farmers), the Soil Conser-ation Service and the Bureau of Reclamation. eople from these groups joined forces to wipe out ne weeds before they got a chance to harm the orld-famous certified Ladino Clover seed crop see article entitled, "Deschutes Does It Again," n page 92 of the May 1951 Reclamation Era.)

Their four-point weed eradication campaign in-ludes (1) seeding canal and lateral rights-of-ay with desirable pasture grasses, (2) installing ock guards to encourage fencing and pasturing, 3) treating patches of noxious weeds like Cana-ian Thistle, Morning Glory and White Top with odium chlorate, and (4) applying 2,4–D to stub-

IN ACTION (top of page)—The 32-foot, five-section spray boom is supported by a steel frame (D), attached to the front bumper. Uprights (E) support the pulleys for the ropes which raise or lower the side sections of the boom. Guy ropes (F) from each side of the cab hold the boom at right angles to the truck so that if the side sections bump against a fence post, high bank, or other obstruction they can swing backward without damage, the tension from the supports, ropes, and pulleys permitting the boom to brush past the obstacles and resume their former position. A steel rack (G) supports the spray boom when not in use. Swivel connections (H) for the side sections (I) permit them to swing from the carrying to an operating position and to be raised or lowered as needed when spraying. Wing sections (J) are hinged so they can be tipped up or down to conform to the contour of the ground or side slopes of ditchbanks. The hand boom has a 150-foot-long ⅜-inch hose line (K), wound on a reel (L), and supported by a 10-foot swivel mast (M), to keep it clear of the rig when in use. A 50-mesh line screen (N) prevents clogging of spray nozzle from the main supply line. From the supply line there is also a hose bypass back to the supply tank to regulate pressure at the control manifold which also acts as an agitator to maintain constant mixing of the spray solution.

DRIVER'S CONTROLS (inset)—The four ropes which raise and lower each section of the boom are attached to short sections of chains to allow quick adjustment by means of metal clips (O) which hold the chain links firmly in place. The clips are supported by a metal frame (P) mounted on the cab. To control the spray solution to each section of the boom (including the hand boom), valves (Q) are mounted in a manifold, connected by ⅜-inch hose lines to the separate boom sections. A 1-inch hose (R) is the main supply line from the pump to the manifold.

born weeds which appear year after year—willows, sweet clover, sour dock and scattered noxious plants.

It is a big job, particularly when you realize that there are 300 miles of canals and laterals on 1,550 acres of rights-of-way in the distribution system of the North Unit. However, the farmers figure that in two or three years the pasture grasses in the "Point One" program will crowd out most of the troublesome annual weeds like Russian thistle and mustard, thus making their "Point Four" program easier—although some spraying will still be necessary to control the sweet clover, willows and other ditchbank weeds.

Giving the weeds a good spray of 2,4–D at the right time stops them in their tracks, cuts out the costly job of removing dried up weeds before the irrigation season, and saves money. During 1949 and 1950 annual weed costs at Deschutes' North Unit dropped 25 percent for the sections sprayed with 2,4–D. Thus the importance to the weed eradication campaign of the new machine for spraying ditchbanks.

In 1949 the men in the Bureau's project shop constructed a spray unit which they mounted on an army-type 4-wheel-drive pickup truck. They hooked up the unit with a fire pump of 50 gallons per minute capacity, powered by a 5 horsepower air-cooled gasoline engine to furnish the pressure.

The spray solution was carried in a 100-gallon tank mounted on the truck bed. Making the unit even more compact, the truck also carried a 20-gallon drum of concentrated chemicals which could be mixed with water and fed into the spra[y] tank when the crew ran out of spray solution whil[e] on the job.

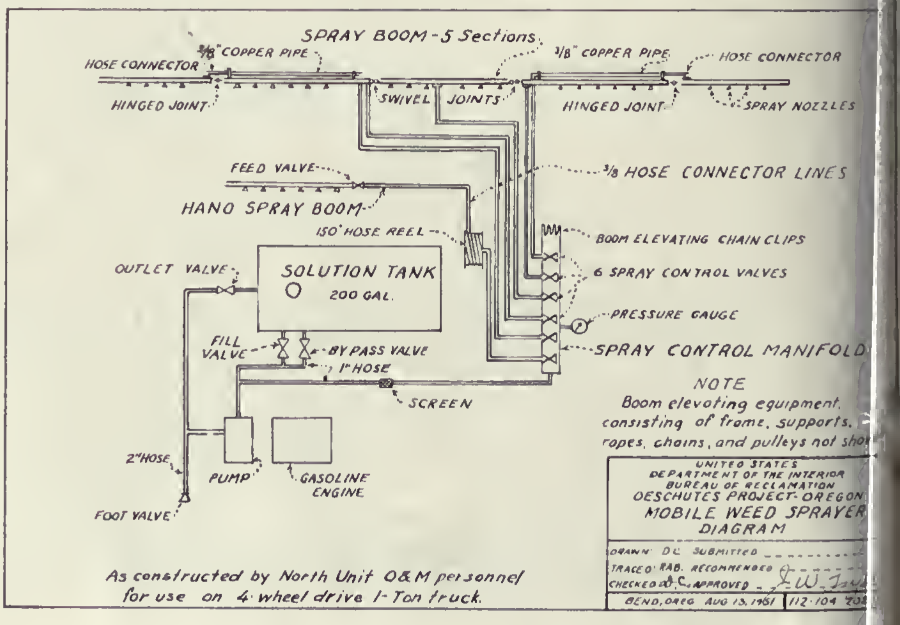
The workmen constructed a 36-foot spray boo[m] in three sections, so that the two outer sectio[ns] could pivot vertically and horizontally. The[y] then mounted the middle section on the truck' bumper. To make certain that no weeds escape[d] in spite of the mobility of the "side arms" of th[e] bumper spray boom, the crew added a hand boo[m] with a hose line 150 feet long for sharp-shootin[g] or scouting weeds beyond the range of the bumpe[r] mounted boom. They constructed special valv[e] controls on the truck cab so the driver could spra[y] from any one, or all sections, at the same time.

But the one unit was not enough to allow th[e] crews to cover all the weeds at the proper stage o[f] growth to prevent their spread and to eliminat[e] the necessity of clearing away dry weeds. So early in 1951, under the supervision of the proje[ct] manager and the irrigation supervisor, the sho[p] foreman went to work again, this time makin[g] several improvements over the first rig.

The second unit was mounted on a 4-wheel driv[e] 1-ton "power wagon" to assure plenty of tractio[n] and power when needed, and had a 25-gallon-pe[r] minute bronze gear pump (which experience ha[s] shown to be adequate for the job) instead of th[e] 50 gpm pump on the first unit. This pump, lik[e] the first one, was run by a 5-horsepower moto[r]. However, the capacity of the spray tank w[as] doubled—a 200-gallon tank being used, and a 5

(Please turn to page 7)

MAKE YOUR OWN "WEEDMOBILE". If your fields are level, you could build your own mobile weed sprayer from the diagram at right. You could even use this rig for treating your crops for weed, insect, and disease control. If your fields are bumpy or irregular, however, write to the Construction Engineer, Deschutes project, at Bend, Oreg., for information on the boom-elevating equipment to make your rig flexible and damage-proof.



A "BONNY" REFUGE for waterfowl has been created in Colorado. At left, part of the estimated 13,000 ducks which made Bonny reservoir their home last November. Below, a bird's-eye view of the dam, looking south. *Photo at left by John N. Berg, Region 7 photographer. Photo below by the Utah Construction Company.*

BONNY DAM— A BARGAIN

by N. BETH WOODIN

Kansas River District, Indianola, Nebr.
Region 7 (Headquarters at Denver, Colo.)

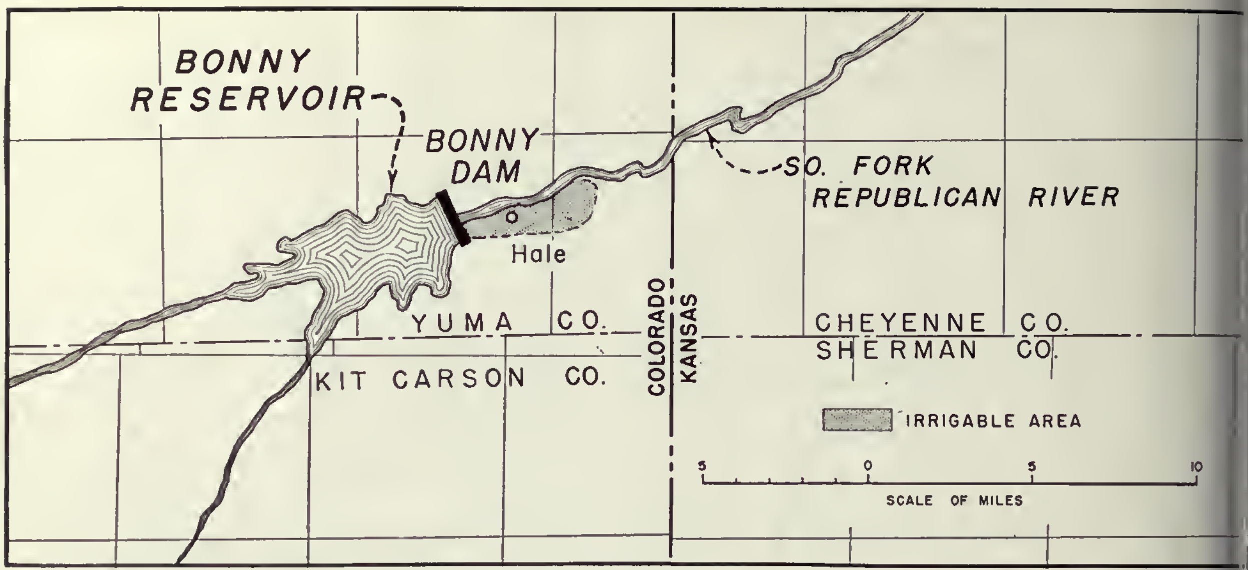
THIS IS THE STORY OF A BARGAIN—the story of w four million dollars and a year and a half time were saved in building a dam for the peo- e of the United States.

Bonny Dam, located on the South Fork of the epublican River near the little town of Hale, olo., was completed and accepted by the Bureau Reclamation on May 4, 1951, 521 days ahead of hedule, at a cost of $13,000,000. The estimated st prior to the opening of bids was $17,047,000.

Much of the credit for this phenomeual ac- mplishment is due the principal contractor, the tah Construction Company of San Francisco, alif., with its staff of highly efficient, energetic, nd resourceful key personnel. During the first ll year (1949) of construction, the Utah Con- ruction Company accomplished 43 percent of the ntract work on what was scheduled to be a 4- ar job. In so doing, they established several w records for earth work on Bureau of Recla- ation projects, excavating over 1,000,000 cubic rds of material a month for 4 consecutive onths, with a maximum of 1,334,000 cubic yards November, and placing over 1,043,000 cubic rds of embankment material the same month.

There were two principal reasons for the saving accruing to the United States in the construction of Bonny Dam. One was the unique methods developed by the contractor which enabled him to submit an extremely favorable bid for the job. The other was that the completion of the work almost a year and a half ahead of schedule substantially reduced the administrative cost to the Government.

Bonny Dam, the principal feature of the St. Francis Unit of the Missouri River Basin project, is situated about six miles west of the Colorado-Kansas State line. It was designed by the Bureau as a multiple-purpose structure providing for irrigation, flood control, silt storage, and other benefits. Although the irrigation phase of the project was determined to be in conflict with existing agreements between the States of Colorado, Kansas, and Nebraska covering the distribution and utilization of the water of the Republican River and its tributaries, Congress appropriated funds in 1948 for the construction of Bonny Dam primarily for flood control. Studies are now essentially completed to determine the most practicable plan for development of the irrigation potentialities without violating existing agreements between the three States.



WAITING FOR A TRI-STATE AGREEMENT covering the distribution and use of Republican River's water is the shaded area around Hale, Colo. In the meantime Bonny Dam, principal feature of the St. Francis Unit of the Missouri River Basin, provides flood control, fish and wildlife, and recreation benefits. *Map by Drafting Section, Washington, D. C.*

Storage of the runoff of the South Fork of the Republican River in Bonny Reservoir will ultimately provide irrigation for 7,000 acres, of which 5,200 acres will be in Colorado, and 1,800 acres in Kansas. The major portion of the area to be irrigated in Colorado is located on a high terrace and will require a pump lift of about 150 feet to divert water to these lands. The lands to be irrigated in Kansas, however, will be mainly valley lands that can be reached with a gravity flow canal.

Bonny Dam is situated in a semi-arid region of the Great Plains normally deficient in precipitation and subject to recurring drought and hot, dry summer winds. The area is also subject to occasional storms of great intensity which transform its normally quiescent streams into raging torrents of destruction. Of the 175,000 acre-feet of storage capacity in the reservoir, 132,000 are allocated to flood control, with the remaining 43,000 reserved for irrigation and silt retention.

The dam is a rolled earthfill structure rising 128 feet above the river bed. It is aproximately 3,200 feet long and over 8,554,000 cubic yards of embankment material were used in its construction. A roadway 30 feet wide was constructed along the dam crest, with a bridge spanning the concrete spillway opening at the north abutment. Rock riprap was used for the protection of the upstream face of the dam, and the downstream slope was protected by seeding the enbankment with mixture of crested and western wheatgrass, b ennial yellow sweet clover, and barley. A grave surfaced road three miles long was constructed provide access to the dam from the north.

Bonny Dam was selected by the Bureau as t site of an upstream embankment protection e periment designed to lower costs for this type work. A test embankment section was co structed on the south shore of the reservoir abo two-thirds of a mile upstream from the dam. B cause of the high cost of rock suitable for ripr ordinarily used in upstream embankment prote tion, Bureau engineers had been experimenti for over two years with a number of substitutes f rock. The results of this research indicated th the two most promising materials were standa (compacted) soil-cement and hot-mix asphalt concrete. These materials were used in the t section. It is too early at this date to predict t success of the experiment; it will take years exposure to freezing and thawing, wind and wa action, and other adverse conditions before its su cess can be determined.

Reservoir clearing operations were completed April 1950 and storage of water in the reserv was begun in July of that year. The reservoir n forms a lake more than three miles long and a m wide and covers 1,620 acres. It has a shoreline $10\frac{1}{2}$ miles. When the lake is filled to normal pacity, it will be about $3\frac{1}{2}$ miles long and miles wide and will cover 2,042 acres. The sh line will be 14 miles and the lake will be about feet deep at its deepest point.

Bonny Reservoir is 75 miles from the nearest [bo]dy of water of comparable size, and it is ex[pe]cted that the area will be used extensively for [re]creational purposes. Approximately 27,000 [pe]ople live within the area the reservoir is expected [to] serve. Already large flocks of ducks and geese [ha]ve stopped at the reservoir in the fall and spring [an]d the area gives evidence of becoming a hunter's [pa]radise. Recreational and wildlife development [is] under way and additional work is planned for [th]e future. A swimming beach and a boat launch[in]g ramp have been completed, and access roads [to] the public recreational area have been gravelled. [Tr]ees and shrubs have been planted in the recrea[tio]nal area and seedling trees in the sites selected [fo]r wildlife habitat development. Construction [of] facilities for the public recreational area were [co]mpleted in December 1951. The Colorado State [Ga]me and Fish Department has stocked the reser[vo]ir with about 100,000 fish, principally bluegills, [ba]ss, and drum.

A memorandum of understanding between the [Bu]reau of Reclamation, the Fish and Wildlife [Se]rvice, and the National Park Service of the De[pa]rtment of the Interior and the Colorado State [Ga]me and Fish Department is being negotiated, [un]der the terms of which the land and water sur[fa]ce of the reservoir area will be administered, [op]erated, and maintained by the Colorado Game [D]epartment. Operation of the reservoir area by [th]e Game Department will start in the spring of [19]52. This will be the first area in the Missouri [R]iver Basin on which such a coordinated reser[vo]ir management plan has been developed and [a]n agreement has been worked out whereby a State [ga]me commission has administrative control over [th]e management of the land and water-surface [ar]ea of an entire federally owned reservoir.

Under the terms of the memorandum of under[st]anding and a specific lease, the Colorado Game [D]epartment will administer the recreational area, [th]e private cabin site area, the organized club [ca]mp area, and all agricultural and grazing lands [in] the reservoir area. Also under the terms of the [a]greement, the Game Department is charged with [th]e enforcement of Federal and State game and [fi]sh laws in the area. Cleland N. Feast, director, [C]olorado State Game and Fish Department, 1530 [S]herman Street, Denver, Colo., and Robert Poley, [W]ildlife Technician, Bonny Dam, Burlington, [C]olo., can be contacted regarding any phase of the [m]anagement of the reservoir area. THE END.

Deschutes' "Weedmobile"

(Continued from page 4)

gallon supply barrel made it possible to carry more than twice the amount of concentrated chemicals than the first unit. The business end of the rig—the spray boom—was 4 inches shorter than the first one, and had five sections, instead of 3, making it more flexible and adjustable. This unit, as can be seen in the accompanying photos and drawing, retained the hand boom with 150-foot-long hose, and valve controls for the truck driver. Other features of the "homemade" spray rig are indicated in the illustrations.

The pump and gasoline motor mounted on one base, and the tank with valves and fittings are all connected with hose lines, so the equipment can be quickly removed and stored and the vehicle can be used for other purposes during the nonspraying season.

Much of the material used in the construction of these two units was on hand in the project warehouse. The estimated cost of the second unit was $450 plus the vehicle. It is believed that a similar unit could be built in a shop using new materials for no more than $650. THE END.

Glen Anne Dam Scheduled for Construction

Secretary of the Interior Oscar L. Chapman announced on October 31 that a contract for construction of the Glen Anne Dam on the Cachuma project in California had been awarded to L. A. and R. S. Crow of El Monte, Calif.

The 250-foot-long and 102-foot-high earth-fill structure will provide a regulating reservoir for Santa Ynez River water to be brought from Cachuma Dam and Reservoir through the 6.4-mile Tecolote Tunnel to irrigate almost 30,000 acres of land near Santa Barbara and furnish 10,300 acre-feet of municipal water to the City of Santa Barbara annually. The distribution will be made via a 28-mile South Coast Conduit.

The primary purpose of the Cachuma project is to provide additional irrigation water for the Goleta, Montecito, Summerland and Carpinteria water districts where the present drain on the underground water supply threatens salt water intrusion which may cause one-third of the irrigated land to revert to dry-land status. The project is also designed to provide a municipal water supply which will permit the orderly expansion of the City of Santa Barbara. •

What's in the Soil?

by E. N. POULSON, Soil Scientist, and L. R. SWARNER, Irrigation Engineer, Boise, Idaho, Region 1 headquarters

(Part one in a series of articles on soil and land classification.)

MUCH OF WHAT WE KNOW about the manage- ment of soils was known long ago. It was a- quired little by little and handed down throug the years from father to son, from man to ma and from nation to nation. But only in the las hundred years have people made a concerted ef fort to delve into the science of that thin layer o the earth's crust that supports life almost en lessly. Progressively, and especially in the las few decades, as has been true of all sciences, so science has engaged the attention of an increasin number of researchers and a vast amount o knowledge is being accumulated.

A productive soil is not a haphazard mass o mineral particles, such as sand, silt, and clay. I consists of both organic and mineral matter mo or less orderly arranged—structurally organize particles between which are cavities and chann filled with organic matter, air and moisture. Th latter are necessary for the microscopic and oth life which inhabits the organic and mineral ma ter and performs an essential function in the li

HAT THIN LAYER OF THE EARTH'S CRUST" . . . must be kept in good condition produce crops. Inset at right, underground wealth in the form of bacterio-culated cowpeas with nitrogen-packed root nodules—necessary for lush, deep-een plant growth. At lower left, on opposite page, a potentially productive l "with organic and mineral matter more or less orderly arranged." Note mblike structure at top, and blocklike arrangement below. *Scenic photo by il Merrit; soil photo by Stan Rasmussen, both Region 1 photographers. Draw- by Lloyd Chellman, Graphics Section, Washington, D. C.*

tween the soil and the vegetation that lives upon

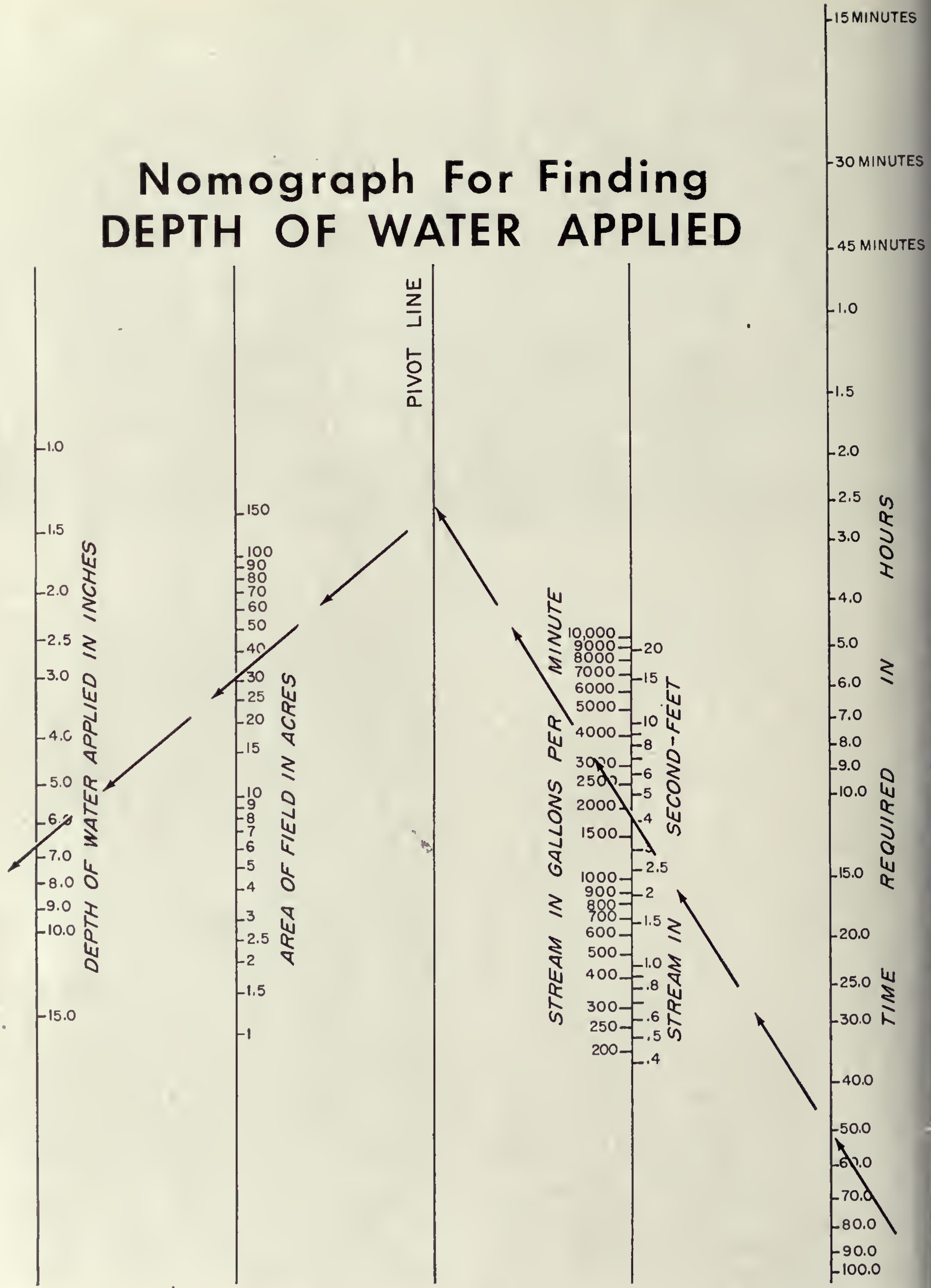
It is obvious that without plant life there would no animal life. But it may be more difficult to alize that the soil which supports the plant life pends upon climate, vegetation, the lay of the nd, parent rock, and time. These factors deter-ine the makeup of the soil and how much plant fe it is able to sustain. It takes ages for nature to ulpture mountains or hills, build plains and val-ys. In the same way nature slowly but thor-ighly molds or conditions geologically weath-ed mineral fragments of sand, silt, and clay into dynamic, natural body capable of providing a nstant supply of life-sustaining nutrients for ant growth from its mineral and organic make-). Certain features of this natural body are most gnificant in producing crops, yet are the most ifficult to recognize and evaluate. For instance, a undful of soil teems with millions of beneficial cteria and molds which live on organic matter. hey play an important part in producing com-ounds that contain the elements needed by plants in such a form that they can be taken into the plants by the roots. If this surprises you, remember that many of our modern wonder drugs come from the soil. Molds taken from the soil produce commercial quantities of penicillin, streptomycin, and other wonder drugs, not yet too well known, that daily save hundreds of lives.

Soil Nitrogen and Organic Matter

The progressive farmer is well aware that lush, deep-green plant growth means plenty of nitrogen in his soil, but he may not know how closely this supply is linked with the activity of the soil's micro-organisms, or minute animal life. Many farmers would be astounded—and who wouldn't be—to know that agricultural chemists have estimated by computation that the air above every acre of land contains about 35,000 tons of nitrogen, which would, if converted into commercial fertilizers, have a value as high as 5 million dollars or more. Although people have learned how to transform gaseous nitrogen into forms useful for

(Please turn to page 16)

Nomograph For Finding
DEPTH OF WATER APPLIED



OF TIME AND WATER

by JAMES GARTON, Assistant Professor,
Oklahoma Agricultural Experiment Station; and
JIM HOWELL, Associate Agricultural Agent,
Jackson County, Oklahoma

How often have you asked yourself, "Am I using the right amount of irrigation water for my crop? Am I running the water too long? Am I wasting water or time?"

Every irrigation farmer knows that when too much water is applied, some will either move downward through the root zone, leaching out valuable plant food on the way or cause too much surface run-off, or do both. He also knows that if he does not apply enough water to thoroughly wet the root zone of his plants, the crop will suffer before the next irrigation.

Here is a nomograph which can give you the answers to these questions, and help you to find out whether you are using too much or too little water on each field and thereby control your irrigation deliveries so that you will use only the amount of water required for a good job.

The nomograph has four scales. Reading from left to right they are: (1) depth of water applied in inches, (2) size of field in acres, (3) rate of water delivered in gallons per minute or second-feet, and (4) time required in hours. If you know three of these quantities, you can determine the fourth. In the example shown, the farmer wants to know how much water he is applying to his field—how many acre-inches of water per acre his crop is getting.

He has ordered water for 50 hours at a rate of 4 second-feet for his 31-acre field. (Technically, a second-foot of water means one cubic foot of water per second. In round numbers this is equal to about 450 gallons a minute. It is a rule of thumb that a stream of one second-foot is equal to one acre-inch of water per hour.) This hypothetical farmer locates 50 hours on the time scale on the far right, and 4 second-feet on the second-feet scale. He places a straight edge through these points, and marks where it crosses the pivot line. From this point on the pivot line, he places the straight edge through 31 on the acres scale and finds that it cuts the inches scale at about 6.5 inches. Therefore, he is applying an average depth of approximately 6.5 inches to the 31 acres.

Now, supposing this farmer is irrigating sugar beets. Like all irrigation farmers he knows the depth of his crop's root zone, which is about 3 feet. From his county agent he learns that the type of soil on his 31 acres will hold water at the rate of 1 inch for every foot of depth. He should, therefore, apply a depth of 3 inches or 3 acre-inches of irrigation water per acre. Now he finds out he has been applying 6.5 inches—more than twice as much water as he needs!

To learn how much to cut down on water delivery, he turns to the nomograph again, working it the other way, from left to right, instead of from right to left. Placing the straight edge at 3, sliding it over to 31, and drawing a line through both, he finds the point on the pivot line. Shifting his straight edge to run from this point on the pivot line through the 4 on the "stream" line, he finds that it crosses the time scale at 22. Accordingly, he can shorten his time of water delivery to 22 hours.

Assuming uniform application of water, these scales on the nomograph will work the same for any field, irrigation stream and time period. It can be used for surface or sprinkler irrigation. Give it a chance to serve you. It may save you time, water, and money. The End.

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THE SALT LAKE AQUEDUCT

TWIN TERMINALS (1). Chlorination and control house (2), the Al[illegible] Draper tunnel (3), Olmstead Tunnel (4), Deer Creek Dam (5), where Salt Lake Aqueduct begins, the Weber-Provo canal (6), and the Duch[illegible] tunnel (7) are major features of this project, which more than double[illegible] water supply for the capital of Utah. Below, a high-pressure, plate-[illegible] section of the Salt Lake Aqueduct. *Photograph of relief model of United States by Raisz and Brown, used by permission of the copy[illegible] owners, Kittredge and Coolidge. Art work by Shirley Briggs, Gra[illegible] Section, Washington, D. C.*

Salt Lake City now has almost twice as much water on tap as it has had during its 105 years of existence.

This water flows from two rivers beyond the Salt Lake Valley, even from the other side of the Continental Divide, merges at Deer Creek reservoir and takes off for a 41-mile journey through a "double jointed" pipeline called the Salt Lake Aqueduct to terminate in twin reservoirs near the southeast city limits of Salt Lake City.

Now the people of Salt Lake City and its suburbs, the farmers in the outlying districts, can turn on their faucets, sprinklers, or other water outlets with confidence, knowing that the water will gush forth when needed.

It was not always thus. Eighty-six years ago (on August 9, 1864 to be exact) Alderman Sheets stood before the Board of Aldermen of "Great Salt Lake City" and asked that artesian wells be bored "to meet the pressing wants of the citizens in watering their lots." This was done. But the "pressing wants of the citizens" grew as more and more people entered the historic valley settled by Brigham Young and his followers, commencing July 24, 1847. And the water supply did not increase. In fact, during the severe drought of 1934 it dwindled to alarming portions. At that time the mountain streams ran dry, and Utah Lake, which was supposed to hold water under exchange agreements from these self-same streams, shrank from 850,000 to 20,000 acre feet—less than one-fortieth its normal size.

The city fathers decided then and there that if there was not enough water in the valley, and never would be enough to meet the needs of the growing city, then water would have to be imported from the outside.

The Bureau of Reclamation in cooperation with the Water Storage Commission of Utah had been studying the area and had a plan for bringing water from the Colorado River basin to the Bonneville basin, merging the waters of the Weber and Provo rivers, storing them in Deer Creek Reservoir and distributing the flow to irrigate the rich farm lands east and north of Utah Lake. According to the plans, there would be enough additional water imported to take care of the needs of Salt Lake City as well as the irrigation farmers, and it would be possible to construct an aqueduct to carry the water to the city.

Here was water—but not for the asking. First, the Salt Lake City corporation applied for membership in the Provo River Water Users Association—the group formed to contract with the Government for repayment of the costs of building Deer Creek Dam and the structures which would carry the water from the other side of the mountains to the farms. The organization was completed on May 2, 1935. Next, the Metropolitan Water District of Salt Lake City was formed and approved by a majority of Salt Lake City electors on August 15, 1935. The city assigned its interest to the district which then had the responsibility of insuring an adequate water supply for Salt Lake City.

Only 3 months later, on November 13, 1935, the Secretary of the Interior (at that time, Harold L. Ickes) put his seal of approval on the project.

In his Finding of Feasibility for the Provo River project, Secretary Ickes found, among other things, that ". . . the furnishing of water for municipal, industrial, and miscellaneous purposes is necessary in order to avoid the further encroachment, for these purposes, upon the present irrigation supply for farm lands."

In other words, when the Provo River project was authorized, unless additional water supplies were developed to meet growing urban requirements, municipalities in the area would be forced to take water from the irrigated farms (exercising their preferential right to condemn irrigation wa-

NORTH TERMINAL—Placing concrete in No. 2 (north) reservoir of Salt Lake Aqueduct Terminal Reservoir. Parley's canyon main gateway to the east can be seen in the background.

ter for municipal use). Since the Provo River project was one of the first Federal Reclamation projects to provide water for municipal use, this justification may be unique in Bureau history. There is little doubt that it was unique at the time.

Another unique feature was the speed with which this Finding of Feasibility received Presidential approval—on November 16, 1935—only three days after the Secretary of the Interior affixed his signature to the document.

By the following spring, on June 27, 1936, the Provo River Water Users Association, of which the Salt Lake Metropolitan Water District is the largest shareholder, executed a contract to repay the costs of the Deer Creek Division of the Provo River project, including a dam and reservoir, within 40 years.

Two years later, on November 16, 1938, the Metropolitan Water District of Salt Lake City signed another, separate, contract providing for the construction of the Aqueduct Division of the project, paving the way for Utah's first multiple-purpose reclamation development, and making the Provo River project one of the first irrigation projects in the Bureau's history to be extended to supply a municipality with water found to be in excess of the project's irrigation needs.

In the meantime, construction had begun in March 1938, under a PWA allotment of $415,000. On December 22, 1938, a month after the Salt Lake Metropolitan Water District signed the contract for construction of the aqueduct, work was begun on the huge pipeline to the city. On January 13, 1939, a separate contract was let for construction of the Alpine-Draper Tunnel and Olmstead Tunnel, combined length 3.5 miles. The storage facilities were completed in October 1941. The remaining aqueduct construction was accomplished under seven additional contracts, and the last reach of the aqueduct was completed October 4, 1950.

Even before the pipeline's terminal was completed, the Metropolitan Water District of Salt Lake City assumed operation and maintenance of the aqueduct, taking over this responsibility on May 1, 1951. The twin-type 40-million-gallon terminal reservoir to regulate flows of the aqueduct into Salt Lake City mains will be completed by the time this issue goes to press, but during construction water flowed from the aqueduct into the city by one of three different routes: (1) bypassing the terminal reservoir and discharging into the existing Samuel C. Park reservoir, (2) bypassing the Samuel C. Park reservoir and discharging directly

BER GASKETS on the spigot ends of the 20-foot concrete sec-
s of the big water pipe made it water-tight (see above). At
er right, columns supporting the Terminal Reservoir roof. At
t, covering Terminal Reservoir No. 2 with a slab roof.

o the city's 48″ feeder main, or (3) spilling into rley's Creek via an emergency overflow struc-e and 48″ diameter wasteway conduit.

Before the District operated the aqueduct last nmer, the City's water supply was 120 million llons per day for a population of approximately),000. W. C. Hagne, former Assistant Super-endent of Salt Lake City Water Works, now ployed by the District as Superintendent of the ueduct, states that 94 million gallons per day nes from flowing wells, the five canyon streams ity Creek, Little Cottonwood Creek, Big Cot-nwood Creek, Mill Creek and Parley's Creek), d three small storage reservoirs. The other 26 llion gallons per day are from 5 deep wells mped directly into distribution reservoirs or ins. These 5 wells are the only active survivors the 17 wells bored in 1934 to meet the drought ergency. Nine are capped for standby use in e event of another dry cycle, and three are no ger usable.

In 1949, the people of Salt Lake City and its burbs used 17,003 million gallons of water. sed on an estimated population of 212,600 ople served, this averaged 219 gallons of water day for each person. This supply system serves square miles in Salt Lake City plus 13 square iles of suburban areas.

The Salt Lake Aqueduct has a rated capacity of 97 million gallons per day (150 cubic feet per second) and could deliver 35,385 million gallons a year—more than double the amount required by Salt Lake City in 1949. However, the District has subscribed to only 15,152 million gallons (46,500 acre-feet) per year, enough to supply Salt Lake City's supplemental needs and to serve irrigators and domestic water groups outside the District. Ultimately, 10,000 acres of suburban land will be irrigated from the District's share of project water, and as the rural areas become urbanized, irrigation users will be converted to domestic use.

The District hopes to make the project self-supporting from the sale of water not required by Salt Lake City. Some water will also be leased on a year-to-year basis for irrigation.

Assuming 219 gallons per day as the average amount each person uses in the Salt Lake City area, the aqueduct and the previous facilities will be more than adequate to serve Salt Lake City for the next twenty years—even with increasing industrial demands and a steadily growing population. In round numbers, the aqueduct can serve an additional population of 187,000 or a total population of about 400,000.

Sound Financing by District

The District is empowered to levy and collect taxes for the purpose of carrying on the operations and paying other obligations of the District, and it is in such good financial condition that on July 1, 1951, it paid the United States government $200,000 in advance to apply on its obligation of approximately $12,900,000.

The aqueduct which made it possible for the people of Salt Lake City to rout the specter of drought, besides being the latest and greatest water carrier in the State, is unusual in many other aspects. In carrying water from the Colorado River basin into the Bonneville basin, one-third of the aqueduct's supply comes from the North Fork of the Duchesne River watershed of 30 square miles. Two-thirds of the supply is drawn from the 163 square miles of the Weber River system watershed. In occasional dry years, surplus waters of the Provo River can be stored in Deer Creek Reservoir for transportation by the aqueduct to supplement the other sources.

The aqueduct's immediate source of supply, Deer Creek Reservoir, has fifty percent more capacity than the rated annual storage requirements of the Provo River project—thus its 152,600 acre-foot (49,725 million gallons) capacity, designed to provide a safe annual yield of 100,000 acre-feet (32,585 million gallons) can easily take care of the District's full supply of 46,500 acre-feet (15,152 million gallons) even in dry years.

If Salt Lake City's population reaches the one million mark, it may be necessary to roll out another barrel alongside the present aqueduct, or find additional storage. But at the beginning of a new year, 1952, thanks to hard work, sound financing, good engineering, and the enterprise of the Metropolitan Water District officials, the Salt Lake Aqueduct and Deer Creek Reservoir are twin safeguards against another year of drought and water shortage like that of 1934. THE END.

Salt River Meets 160-Acre Requirement

When the last holder of excess lands in the Sa River project in central Arizona complied wi the 160-acre limitation of Reclamation Law la year, the Bureau's Region 3, which includes m of Arizona, southern California, Nevada, a smal portion of southwest Utah and part of wester New Mexico, found itself in full compliance wi the limitation law for the first time in a numbe of years.

According to Region 3's regional director, E. Moritz of Boulder City, Nev., this voluntary co pliance with the law was brought about large through the efforts of J. F. Griswold, Secretary the Salt River Valley Water Users Associatio which operates the project.

The 160-acre limitation is a provision of Rec mation Law which prohibits delivery of water t more than 160 acres of land in single ownershi and 320 acres held jointly or as community pro erty by husband and wife. The purpose of t excess land limitation is to afford the great number of farms possible to settlers on Reclam tion projects which will permit them to mak profitable living. During the depression yea acreage in excess of 160 acres was accumulated many of the older projects. Since then landow ers have gradually disposed of their excess hol ings. •

What's in the Soil?

(Continued from page 9)

munitions and fertilizers by building elabora and costly manufacturing plants, there are uns millions of organisms which remove nitrogen fr the air endlessly and plentifully to build the selves up—that is, if soil conditions are rig Good soil conditions include a good supply other mineral elements, good aeration, reasona temperatures, sufficient moisture and a plenti supply of organic residues from the decay of lea and straw. It further lies within the farme power to draw cheaply upon this tremendous serve by the simple use of legumes such as alfal the roots of which harbor other "nitrogen-fixi bacteria and build yearly into each acre additio nitrates worth at least $20 or $30 and also a organic residues, such as roots and crowns, wh in turn stimulate life in the soil.

In addition to serving as a medium for grow of micro-organisms, organic matter helps to m neral nutrients available to the crops, contributes to a better mechanical and structural condition, improves soil moisture conditions, and imparts other desirable effects on the soil. The character of the organic fraction of the soil is constantly changing through decay. Unless organic manures and crop residues are added to maintain active decomposition, unfavorable changes in the amount and character of the organic fractions will occur.

These changes are more rapid in cultivated soils because plants which ordinarily become residues are removed, taking the nutrients they have used and causing certain microbes to slow down their activity. Erosion removes the topsoil along with the nutrients. It is important to maintain a desirable level of organic matter and proper bacterial activity under cultivation. Even in soils which have a naturally high organic content of 4 to 5 percent, such as the grasslands of the Midwest, the amount of organic matter usually sinks below the level occurring under virgin conditions. The systems of agriculture practiced in the past in many parts of this country drew excessively on the virgin fertility which developed slowly as organic debris accumulated over long periods of time. Although it has been demonstrated that commercial fertilizers can be relied upon to maintain the plant nutrient level in most particulars, soil productivity will generally diminish as the organic matter is depleted. If you want a productive soil, you need more than an adequate supply of plant nutrients. A large number of coordinating factors, many of which are favorably influenced by organic matter, must be considered. The organic matter content is normally very low—about 1 or 2 percent—soils that require application of water for satisfactory crop production. Of course, there are notable exceptions, such as the Klamath Basin of Oregon and California, and the San Pete Valley of Utah where the

THE SOIL'S THE THING which in a large measure determines the success of a Federal Reclamation project. At left, a deep, permeable, fertile soil, well suited to irrigation. At right, a soil with a clay-pan layer (P) at a depth of 27 inches—not well suited to irrigation. *Photos by Phil Merritt, Region 1 photographer.*

soils are so highly organic that although special cropping and fertilizing are necessary, the addition of organic matter would be folly. In most instances, however, it cannot be emphasized strongly enough that the relations between soil moisture and organic matter are completely altered under irrigation. The farmer has the power to increase or, at least, maintain the humus content by following certain proved practices: (1) proper rotations which include pastures and legumes such as alfalfa and clover; (2) return of crop residues and plowing under green manures, and (3) adding animal manures and fertilizers. In the initial stages of irrigation the changing soil environment promotes a very rapid increase in the micro-organisms so essential in maintaining a satisfactory level of fertility. Usually under normal farming practices, as many as five years may be required to establish a satisfactory organic matter equilibrium so that such cash crops as sugar beets and potatoes will produce desirable yields.

(Next Month—ELEMENTS IN THE SOIL)

WHAT'S IN YOUR SOIL???

Proper testing of soils takes experience!!!

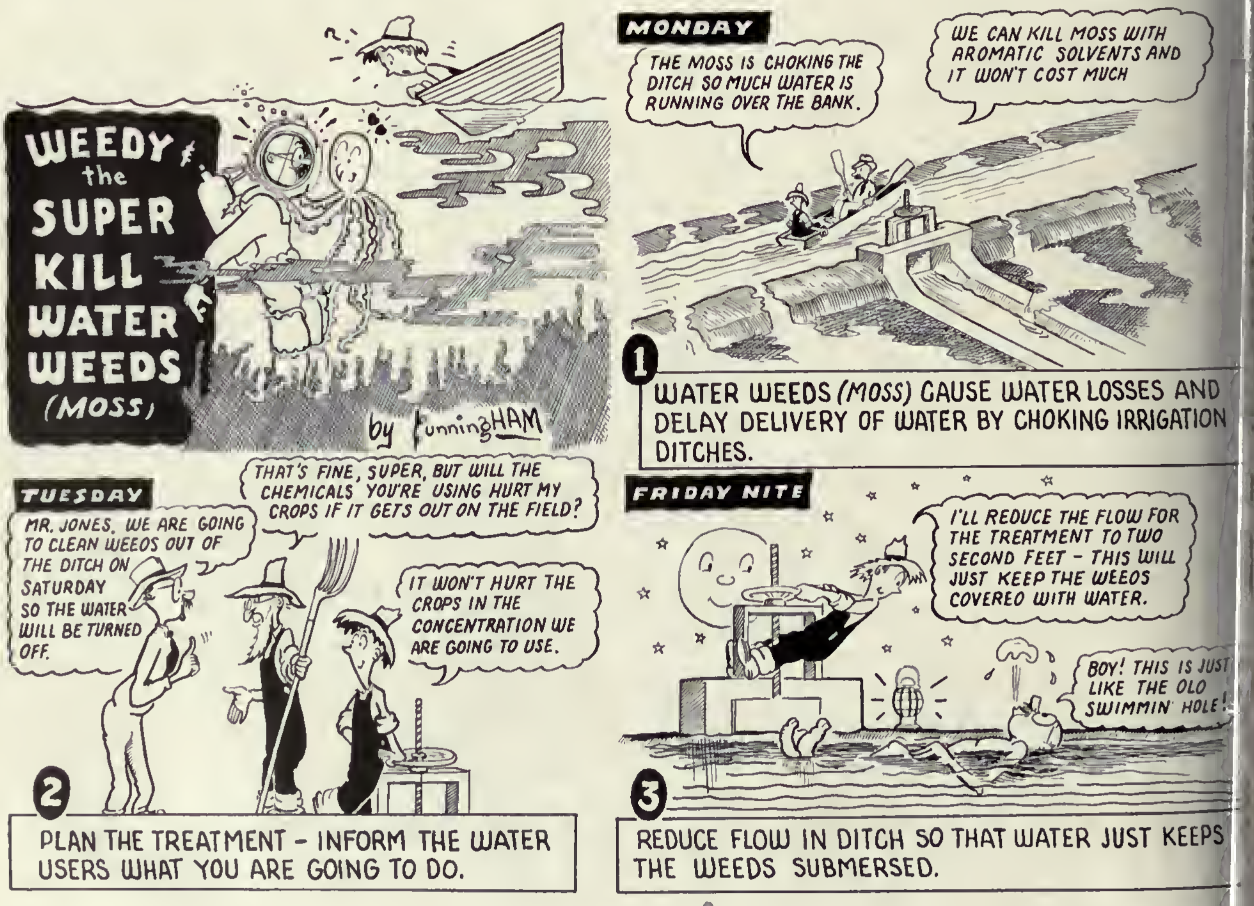
If you have any questions regarding the soil on your farm, you had better see your county agent. He may have field or laboratory equipment to make the more simple tests and for the solution of more complex problems he will refer you to the proper person at the State Agricultural Experiment Station. Your county agent also can give you valuable information on how to take soil samples, package them and ship them—if that should be necessary in order to find out what is in your soil.

SHORT CUTS TO WEED KILLING CALCULATIONS

PART 8—How To Apply Aromatic Solvents To Control Waterweeds

Weeds growing under water in irrigation ditches cause large water losses and expensive maintenance problems. Particularly troublesome are submersed aquatic plants or "moss." Algae, such as blanket moss, frog moss or pond scum, are controlled with copper sulphate or RADA (See Nov. 1951 Reclamation Era) while other submersed aquatics, such as pondweeds, are controlled with aromatic solvents (see April, May 1950 and May 1948 Reclamation Era).

Successful control of pondweeds depends upon obtaining a specified concentration of solvent during a given time interval and accurately measuring the ditch flow. The joint report CH 97, "Controlling Submersed Waterweeds," available fro your nearest Regional Director, gives concentra tion and contact time recommendations. Th nomogram on the opposite page will quickly com pute the amount of aromatic solvents needed du ing the specified contact time. Making this ca culation is the first step toward effective contr The second step is to calibrate the spray rig so th the discharge from each nozzle introduces th chemical into the water at the correct rate. Bot steps are essential if chemical wastage is to be pre vented and good kills obtained. Next month's ar ticle in this series will show how to calibrate th rig for applying aromatic solvents. •



›y JOHN T. MALETIC

;oil Scientist and Weed ;pecialist

Region 7 Headquarters Denver, Colo.

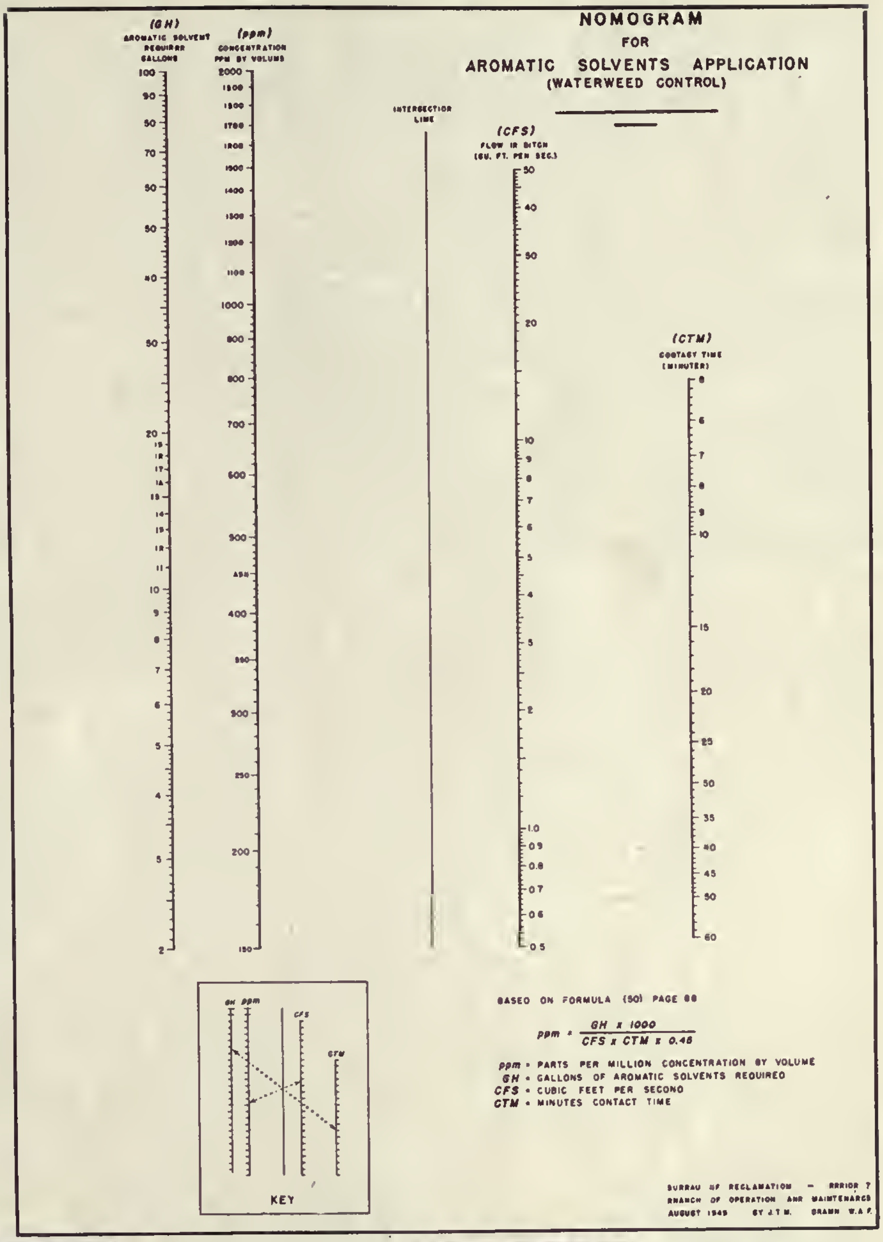
INSTRUCTIONS AND EXAMPLE

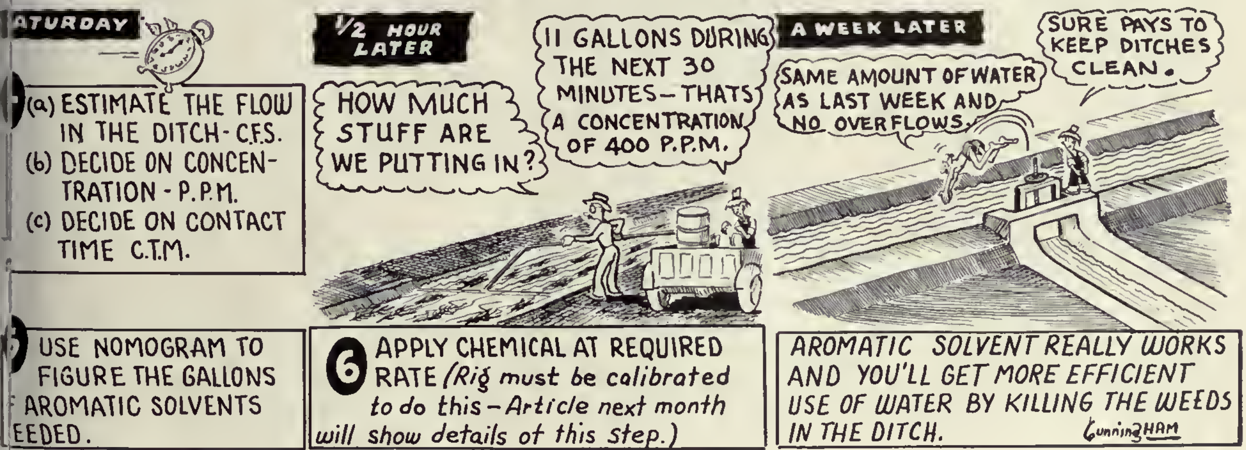
nis chart will quickly and easily ulate the gallons of aromatic sol-s needed to control submerged atic plants like sago pondweed, ned pondweed, Richardson's pond-d, American pondweed, elodea, ntail, and widgeon grass. The key he lower left-hand corner shows to use the chart. Simply connect scales with a transparent straight-e as shown by the dashed line in key.

uppose you are making application romatic solvents in a lateral whose has been reduced to 6 cubic feet second. The recommended appli-on for the weeds involved is a centration of 400 parts per million 30 minutes contact time. How h aromatic solvents is needed? nect 400 ppm with 6 CFS. Mark point where the straightedge ses the reference line. Connect the nt on the reference line with 30 A, and read the answer—32 gal-s on the GH scale.

IER'S INCHES—If desired, you can brate the CFS scale to read In er's inches. Suppose 50 miner's nes equals 1 cubic foot per sec-—opposite 1 on the CFS scale in-50, opposite 2 CFS enter 100, posite 3 CFS enter 150, and so forth the remainder of the scale and the rmediate points. Computation is n made in the usual manner as wn in the key.

ditor's Note: Unless you are as good a mmer as Super, and have an expert life-ng friend like Weedy an share, don't m in irrigation ditches—it's dangerous.





FOUR-MILLIONTH VISITOR to take guided tour of Hoover (Boulder) Dam. Mrs. William C. Carr, of Los Angeles, Calif., stands across the border with her son Chuck on the Nevada side of the Hoover power plant and talks to her daughter Myra and her husband who are on the Arizona side. ***Photograph by Mark Swain, Region 3.***

Lake Mead Places Second in Popularity

Reclamation's Lake Mead, behind Hoover D[illegible] on the Colorado River in Arizona-Nevada, [illegible]tracted 2,052,786 visitors in the 1951 travel y[illegible] thus becoming the second most popular rec[illegible]tional area in the entire National Park Syst[illegible] It was outranked only by the Blue Ridge Nati[illegible] Parkway in Virginia, North Carolina and T[illegible]nessee, which was visited by 2,454,924 persons.

The Lake Mead total showed a substantial [illegible]crease over the previous year, when 1,757 [illegible] people were recorded as visitors in the recreati[illegible] area administered by the National Park Servic[illegible]

Other recreational spots provided by Burea[illegible] Reclamation projects also attracted number[illegible] vacationists and visitors during the year, the [illegible]tional Park service reporting 300,071 visitor[illegible] Coulee Dam, on the Columbia River in Wash[illegible]ton State, and 462,916 visitors at Millerton L[illegible] behind Friant Dam on the San Joaquin Rive[illegible] California. ●

Water for the Wellton-Mohawk

(Continued from page 2)

there were 11,000 acres. Cotton then occupied 60 percent of the area, while alfalfa grew on 25 percent.

Prior to this time periodic floods recharged the underground waters. However, as increasing upstream use made these floods less and less frequent, the volume of the underground water dropped and its quality deteriorated. Wells and farms were abandoned. There was a rapid decline in farming from 1931 to 1935 and a shift toward alfalfa seed and Bermuda grass seed production. These were the only crops which could be grown profitably with the saline water and on lands that were gradually becoming even more saline. By 1936 alfalfa occupied 72 percent of the area and cotton only 16 percent. The cotton acreage continued to decrease, and by 1940 only Bermuda grass and in a few cases alfalfa could cope with the salty water and soil. In the spring of 1941 floods on the river covered some of the fields. Much of the surface salts was flushed off and carried away. The salty ground water was rejuvenated with a large supply of fresh water. The next two years gave the valley's farmers the highest yields of alfalfa and Bermuda grass seed on record.

But after 1943 history repeated itself. W[illegible] analyses in 1945 showed an average of over [illegible] parts per million soluble salts for all wells in [illegible] Mohawk municipal water conservation dist[illegible] Some wells yielded water of 12,000 parts per [illegible]lion salts. This is far in excess of the allow[illegible] salt content for general farming.

A few farmers fortunate enough to have [illegible] quality water have continued to produce alf[illegible] seed, Bermuda grass seed, and small acreage[illegible] grain sorghum and barley. But they know [illegible] without the rescue supply promised by the W[illegible]ton-Mohawk canal, their farming operations[illegible] would be doomed.

Had it not been for such "salts of the eart[illegible] R. H. McElhaney and Wayne T. Wright, tog[illegible] with their neighbors, the agriculture of the v[illegible] would have continued to deteriorate. Con[illegible] listened to the pleas of these farmers and in [illegible] reauthorized the Gila project to include the 7[illegible] acres in the Wellton-Mohawk division. Con[illegible]ing testimony before Congressional committe[illegible] McElhaney, Wright, H. J. Woodhouse, [illegible] Batley, Charley Buckeye, Robert J. Moody[illegible]mer Yuma County agent, and others have br[illegible] the necessary Federal funds thus far to buil[illegible] irrigation system. Farmers on the Wellto[illegible]hawk division have formed the Wellton-Mo[illegible] irrigation and drainage district (replacing t[illegible]

a Valley Power District and the Mohawk mu-
ipal water conservation district) to repay costs he system over a 60-year period. They elected Elhaney president. And last November the rd of directors and the Secretary of Interior eed on the form of the repayment contract ich the water users are now considering—a con- ct which will bring irrigation water to a maxi- m of 75,000 acres of Wellton-Mohawk land.

o be concluded next month—FARMERS AND THE FUTURE)

h Protection at Folsom and Nimbus Dams

lthough several miles of spawning grounds the American river salmon run will be cut off en California's Folsom and Nimbus dams are npleted, a tripled riffle area to improve the wning grounds below the dams is being nned to salvage the salmon run which amounts 15,000 each year.

Fish and Wildlife Service experts are cooperat- with the Bureau of Reclamation in this latest the salmon salvaging programs. In the case of asta and Keswick dams on the Sacramento Riv- (see article entitled, "Sacramento Salmon Re- tled," on page 143, August 1948 RECLAMATION A) improved flow conditions, a system of fish ps, and a hatchery more than made up for the t spawning ground.

Present studies of the effects of high water on enlarged riffle below Fair Oaks bridge may im- ove the spawning areas below the dams and thus ke it unnecessary to construct a hatchery. ●

st Missouri Basin Contract in North Dakota Signed

With the signing of an irrigation water service d repayment contract on October 18, 1951, the rt Clark Irrigation District became the first ganization in North Dakota to execute a Recla- ation contract under the Missouri River Basin an.

Under the 40-year contract, the Bureau will ild a pumping plant to lift water from the Mis- uri River, construct two main canals with a com- ned length of 9.6 miles, plus a distribution sys- m to carry the water to each individual farm, thus providing irrigation water for 1,800 acres of land in the District. The Fort Clark Unit, which is one of 15 proposed irrigation pumping units along the Missouri in North Dakota, lies on the west bank of the river about 45 miles from Mandan and Bismarck, in Mercer and Oliver Counties. In return for these facilities, the District will make annual payments for water service, repay the cost of the distribution system and pay for operation and maintenance. The irrigation works will be turned over to the District by the Government for operation and maintenance whenever the water users are able to assume administrative and financial responsibilities for the undertaking.

The water users of the area cast an overwhelming vote in favor of forming the district to contract with the Government. Subsequently the District organization proceedings and the water contract approved by the voters were confirmed by an order of the district court in North Dakota. The signing and execution of the contract by the District gave the go-ahead signal for starting work on the project, which is scheduled for the beginning of the spring 1952 construction season. ●

FORT CLARK UNIT CONTRACT—Participants in the informal ceremony: (seated, l. to r.) North Dakota Governor Norman Brunsdale, Joseph G. Gustafson, chairman of the irrigation district board of directors, and William E. Warne, then assistant secretary of the Interior Department. Standing, l. to r., are Einer Dahl, member of the North Dakota State Water Commission; J. J. Walsh, North Dakota State engineer; Frank Brazda, member of the district board of directors; Bruce Johnson, manager of the Bureau's Missouri-Souris District; Ted Danielson, member of the irrigation district board of directors, and G. A. Freeman, acting supervisor of the Missouri-Souris District operation and development division.

Easterners See Their Machines Producing Grand Coulee Power

HONORED ARTISANS—representing the thousands of craftsmen who combined their talents to create the world's largest power plant at Grand Coulee Dam—from left to right: John S. Bates, superintendent of operation for the Bureau of Reclamation; Charles A. Jinkner, veteran worker for Westinghouse Electric Corp., Pittsburgh, Pa.; Arthur J. Sandler, Westinghouse service engineer on installation of the units; Abel Lester, Newport News, Va., who worked on the 18 hydraulic turbines at the factory, and Homer Phillips, supervising field engineer at Coulee Dam for the Newport News Shipbuilding & Drydock Co. Missing from the photo is William A. Miller, Bureau of Reclamation master mechanic, the sixth representative for the craftsmen.

Two men from eastern factories who had been working on the hydraulic turbines and generators for the Grand Coulee Dam the past 11 years, but who had never seen the completed machines in action shared in the honor of starting the eighteenth, and last 108,000-kilowatt unit on Friday September 14, 1951, at Coulee Dam, Wash.

The men were brought to the dam site by special arrangements made with the Westinghouse Electric Corp., Pittsburgh, Pa., manufacturers of the 18 generators, and the Newport News Shipbuilding & Dry Dock Co. of Newport News, Va., manufacturers of the 165,000-horsepower turbines.

The men are Charles A. Jinkner, of Greenburg, Pa., assistant superintendent in the Westinghouse Transportation and Generator Division who started work in 1907 when George Westinghouse was a frequent visitor to the plant, and Abel Lester of Newport News, Va., assistant foreman in the heavy machine shop, who has been engaged in hydraulic turbine work for 35 years.

Four other workmen who have been supervising the installation of the giant units or operating them after completion also were chosen to participate in a half-hour recorded program for three radio networks in the control room of the Grand Coulee Dam right powerhouse.

The Industrial Committee of the Grand Coulee Chamber of Commerce, represented by its chairman Cliff Carlson, sponsored the event.

Because of security restriction, the general public was not invited inside the powerhouse to see the starting of the last unit. Press, radio, and television reporters, however, carried the word of the ceremony into the homes across the nation.

The first generator went into service at the dam approximately 10 years ago, on March 2 1941. •

Colorado A & M Offers Ph. D. in Irrigation Engineering

The governing board of the Colorado Agricultural and Mechanical College at Fort Collins, Colo. has approved a Ph. D. in Irrigation Engineering. This is the first doctor's degree offered by the College and is in a field for which it has achieved a notable record since 1887.

The degree will be administered in the department of Civil Engineering, which has been offering advanced work in Irrigation Engineering for many years. Dr. D. F. Peterson is head of the Department. The work will be given in conjunction with programs of the Irrigation Institute. These are broad and are intended to cover all aspects of the field of irrigation agriculture. In engineering it can include theoretical or applied fluid mechanics, design, soils and water, operation and management, or project planning.

Students can be accepted at any time to begin work toward the doctorate. A limited number of teaching and research fellowships are available. •

CROPS

Crops at Carlsbad

ng 44 years of irrigation farming acilities originally rehabilitated nstructed by the Bureau of Recon (or its predecessor the Recon Service) farmers on the ad project in New Mexico procrops valued at over 50 million . Between 1907 and 1951, they over 300 thousand bales of cotton, 00 thousand tons of cotton seed most 600 thousand tons of alfalfa An average of about 20,000 acres d has been irrigated annually 1907.

ll grains and sorghums for grain rage have always occupied some nd although farmers started raisuits and vegetables, they have ally shifted to cotton production vegetables and truck crops have e less and less important. ●

OREIGN ACTIVITIES

ther step toward sealing the bond endly relations with one of our neighbors has been made in the of an agreement between the l States and the Commonwealth stralia. This agreement, signed vember 16 by Mr. Thomas A. Lang, iate Commissioner of the Snowy ains Hydroelectric Authority of alia, and Mr. Goodrich W. Liner, Acting Commissioner of the u. falls within the terms of Title Public Law 402, the United States nation and Educational Exchange f 1948, which authorizes the proof facilities of United States nment agencies to promote the se of the act. The facilities to be led by the United States in this ce include the training of about nior Australian engineers a year e next several years in the Bu installation at Denver, Colo., and sign of certain works to be under by the Australian Snowy Moun Hydroelectric Authority. All of penses incurred by the Bureau for ssistance will be completely paid the Snowy Mountains Authority. This Authority, similar in scope and form to the TVA, covers an area of about 100 miles in length by 50 miles broad, approximately 70 miles southwest of Canberra, the Capital of Australia. It is expected to provide additional water for existing and proposed irrigation systems, and hydroelectric power much needed in industrial Sydney and Melbourne and adjoining rural areas. It will include 8 major dams, over 80 miles of tunnels, 400 miles of canals, and some 16 power stations with a total capacity of about 3 million kilowatts. The Bureau, with the assistance of the Australian engineer-trainees, will perform part of the design work on the Upper Tumut group of works. These works, which will provide about 666,000 horsepower, would normally take ten or eleven years to complete, but with the help of outside contractors and designers it is expected that the project can be completed in 6 years.

Bureau engineers continue to accept foreign assignments in the fields of water resources development, irrigation and drainage, and hydroelectric power surveys, at the request of the Department of State and the Mutual Security Administration, in order that they might aid in carrying out the President's Point IV Program of technical assistance to underdeveloped countries. A few of the Bureau engineers assigned such missions are:

JORDAN—Mr. Mills E. Bunger has just returned from a 60-day detail in Amman, Jordan, where he completed a review of the water resources phase of the Economic Cooperation Administration's program in that country.

NORTHERN RHODESIA—Mr. Edgar Foster of the Hydrology Division in Denver, recently returned from 6 months' assignment to Northern Rhodesia.

NICARAGUA—Mr. Norval Pope and Mr. Foster (see above) are on a 1 year's assignment to make preliminary surveys and investigations of the Tuma and other rivers of Western Nicaragua, with a view to the development of hydroelectric power. These assignments are expected to be completed by June 1952.

IRAQ—Mr. Fred Locher, of Great Falls, Mont., has accepted an assignment as irrigation and drainage engineer in Iraq, to carry out an experimental drainage program preliminary to drawing a full and comprehensive program of drainage for the Dujaila irrigation system within Kut and Amara Liwas. He will also recommend the site, the size and scope of this experimental drainage work. This work will be undertaken to educate the farmers and landholders of the district regarding the benefits of these works and train them to carry out similar but smaller works where necessary within their holdings.

CHILE—Mr. Kenneth Vernon, Regional Director of Billings, Mont., was invoted by the United Nations Food and Agriculture Organization to conduct a series of lectures at the Latin American Training Center in Santiago, Chile, from December 10 to 14, 1951. The subject of Mr. Vernon's talks was river basin development.

Requests for permission to visit Bureau installations continue to reach the Bureau through the Department of State. There are an average of 24 visitors, representing about 11 countries, each month.

Some of the recent foreign nationals accepted for in-service training in the Chief Engineer's office and on projects, include: Medina N. Bhattarai of Nepal; Mir Bashar Khan and Hasan Shahid Saidi of Pakistan; Somnath Kapur of India; Sayed Ohanessian of Iraq, and Najeeb F. Tleel, Jordan. ●

RELEASES

Water and the World

The Commissioner's Office in Washington, D. C., has available, free of charge, copies of the article, entitled "Water and the World" by William E. Warne, reprinted from the September 1951 issue. These reprints are being used to advantage by groups and persons studying international water conservation problems. ●

OUR BACK COVER is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners, Kittredge and Coolidge.

NOTES FOR CONTRACTORS

Contracts Awarded During November 1951

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contr amou
DS-3527	Colorado-Big Thompson, Colo.	Nov. 8	One 1,000-kilovolt-ampere unit substation for Flatiron power and pumping plant, schedule No. 1.	Nelson Electric Mfg. Co., Tulsa, Okla.	$22
DC-3540	do	Nov. 6	Construction of 9.5 miles of Estes-Pole Hill 115-kilovolt transmission line.	Sturgeon Electric Co., Inc., Denver, Colo.	125
DC-3547	do	Nov. 8	Construction of Carter Lake pressure conduit, Estes Park-Foothills power aqueduct, schedule No. 1.	Colorado Constructors, Inc., Denver, Colo.	21
DS-3549	do	Nov. 27	One main control board and one recording board for Flatiron power and pumping plant.	Kirkhof Electric Co., Grand Rapids, Mich.	87
DC-3551	Central Valley, Calif.	Nov. 8	Construction of Columbia pumping plant No. 1 and Mowry pumping plant and delivery systems.	Johnson Western Constructors, San Pedro, Calif.	33
DS-3552	Colorado-Big Thompson, Colo.	Nov. 14	One 42-inch regulating tube valve with control stand and connecting piping for pump-turbine bypass, Flatiron power and pumping plant.	Pelton Water Wheel Co., San Francisco, Calif.	38
DC-3553	Columbia Basin, Wash.	Nov. 15	Preliminary drilling for stabilization of right bank, Grand Coulee Dam.	Forest H. Majors, Salt Lake City, Utah.	22
DC-3554	Missouri River Basin, Nebr.	Nov. 2	Construction of earthwork and structures for Cambridge Canal, and drains and channel changes, schedule No. 5.	Claussen-Olson-Benner, Inc., Holdrege, Nebr.	774
DC-3557	Columbia Basin, Wash.	Nov. 8	Alterations of pump discharge pipes No. 1 to 6, inclusive, and repair of pump discharge pipe No. 1, Grand Coulee pumping plant.	Consolidated Western Steel Corp., San Francisco, Calif.	60
DC-3558	Eden, Wyo.	Nov. 5	Construction of earthwork and structures for Means Canal and Big Sandy Channel change.	Sharrock and Pursel, Casper, Wyo.	315
DC-3560	Davis Dam, Ariz.-Nev.	Nov. 20	Installation of metalwork, heating and ventilating systems, and piping for Davis Dam and power plant.	Dorrington Sheet Metal Works, Denver, Colo.	18
DC-3561	Parker Dam Power, Ariz.-Calif.	Nov. 16	Repairing turbine runners for Units 1 to 4, inclusive, Parker power plant.	S and S Engineering Corp., Los Angeles, Calif.	14
DC-3568	Central Valley, Calif.	Nov. 20	Three actuator-type governors with pumping equipment for regulating speed of 74,000-horsepower hydraulic turbines for Folsom power plant.	Woodward Governor Co., Rockford, Ill.	97
DC-3578	Columbia Basin, Wash.	Nov. 21	Construction of earthwork, pipe lines, and structures, part-time farm units, Block 701 laterals.	George Pfeiffer, Spokane, Wash.	41
DC-3592	Boulder Canyon, Ariz.-Calif.	Nov. 15	Completion of construction for operation of Units A3, A4, and A9, and related switchyards, Hoover power plant.	Howard P. Foley, Salt Lake City, Utah.	211
117C-121	Columbia Basin, Wash.	Nov. 1	Construction residences, garages and utilities for Areas E-2, E-3, P-1, and P-2, O&M ditchrider sites.	Bowe, Nevers and Masser, Inc., and Allied Construction Co., Ephrata, Wash.	9
117C-124	do	Nov. 16	Drainage culvert at station 2619+27.50, West Canal.	Goodfellow Brothers, Inc., Wenatchee, Wash.	1
604C-24	Missouri River Basin, Mont.	Nov. 5	Clearing Canyon Ferry Reservoir Areas 5 and 6.	Lindquist, Olson, and Co., Cambridge, Min.	18
701C-200	Missouri River Basin, Nebr.	Nov. 23	Relocation of County road at Swanson Reservoir.	Nichols Construction Co., Geneva, Nebr.	11
704C-210	Colorado-Big Thompson, Colo.	Nov. 2	Fort Collins R. E. A. substation and addition to Flatiron temporary substation.	Walter Walking, Denver, Colo.	2

Construction and Materials for Which Bids Will Be Requested by March 1952

Project	Description of work or material
Cachuma, Calif.	Construction of the Carpinteria Reservoir located northeast of the town of Carpinteria, Calif. The reservoir is to be 25 feet deep and 240 feet square at the bottom with 1½:1 inner slopes. The bottom and inside slopes will be paved with concrete.
Do	Construction of fence around Cachuma dam and outlet works and around Glen Anne and Lauro Reservoirs.
Central Valley, Calif.	Construction of ditch riders' houses at Balancing Reservoir and Kern River on Friant-Kern Canal near Bakersfield, Calif. Each house is to be wood frame on concrete foundation and is to contain not more than 1,200 square feet of living area and 470 square feet of garage and storage utility area.
Do	Two 9,400-horsepower at 40-foot head, vertical-shaft, propeller-type hydraulic turbines for Nimbus power plant.
Do	Two 7,000/8, 750-kilovolt-ampere outdoor power transformers, seven 69-kilovolt disconnecting switches, and one 69-kilovolt power circuit breaker for Nimbus switchyard.
Do	Three 230-kilovolt, and one 69-kilovolt outdoor power circuit breakers; three 115-kilovolt, seven 230-kilovolt, and five 69-kilovolt disconnecting switches; one 12,000/15,000-kilovolt-ampere outdoor autotransformer; one 4,160-volt outdoor unit substation switchgear for Folsom switchyard.
Do	Three 230,000-volt outdoor power circuit breakers and nine 230,000-volt outdoor disconnecting switches for Elverta switchyard.
Colorado-Big Thompson, Colo.	Construction of Pole Hill Canal 9 miles east of Estes Park, Colo., involves construction of about 500 feet of bench flume and 2,000 feet of canal to carry a flow of 550 cubic feet per second. The concrete flume has a bottom width of 16 feet 3 inches and a height of 8 feet 8 inches. The concrete-lined canal has a bottom width of 7 feet, a height of 8 feet, and side slopes of 1¼ to 1. Most of the excavation will be in rock.
Colorado-Big Thompson, Colo.—Con.	Installation of carrier-current and control equip including 10,000 feet of cable, at Flatiron power Greeley, and Sterling, Colo., and intermediate p and installation of instrument panels and dispat equipment for completion of Flatiron dispatch ing near Estes Park, Colo.
Do	Two 84-inch butterfly valves with operating handling equipment, and accessories for Fl power plant.
Do	Two neutral grounding reactors for Flatiron plant.
Columbia Basin, Wash.	Reissuance of Specifications No. DC-3537 for con tion of Lake Lenore pumping plants near Soap Wash., incorporates a redesign of pumping No. 1. Construction of pumping plants Nos. involves installation of three 10-cubic feet per and one 5-cubic feet per second pumping u each plant, manifolds and discharge lines, and trical installations; construction of 0.3 mile of channel and 2.1 miles of connecting channel struction of 0.2 mile of 36-inch diameter concret discharge line; construction of a weir and was structures near pumping plant No. 2; and re and reconstruction of concrete manhole struct existing Soap Lake siphon and connecting discharge line to the siphon.
Do	Construction of 236-cubic feet per second ca 4-unit, outdoor-type Ringold pumping plant. contractor will construct the 53- by 22-foot rei concrete foundation, install Government-f pumping units, construct steel motor housin four 42-inch diameter concrete pipe discharg each extending about 650 feet to the outlet w
Do	Installation of two 65,000-horsepower, 720,000-gal minute pumping units Nos. P5 and P6 in Coulee pumping plant; miscellaneous metalw electrical installations for Grand Coulee Dam, ing plant, and power plants.

Project	Description of work or material
bia Basin, —Con.	Installation of lighting standards, luminaries, wiring and control circuits in town of Coulee Dam, Wash.
	Construction of 1.5 miles of unlined laterals, 2 miles of wasteways, and 3 small pumping plants to irrigate additional acreage in lateral areas E-2 and E-3 on East Low canal.
	Landscaping of school area and terraces in town of Coulee Dam, areas adjacent to pumping plant and hydraulic model, and in vicinity of Grand Coulee 230-kilovolt left switchyard.
	Furnishing and placing lawn, shrubs, and trees, and furnishing and installing materials and equipment for lawn sprinkler systems at Mesa, Moses Lake, Warden, and Winchester, Wash., operation and maintenance headquarters.
	Drilling domestic water-supply well for Othello development farm.
	Drilling 40 drainage observation wells in lateral areas E-3 on East Low canal, near Moses Lake, Wash. W-5 and W-6A on West canal, near Quincy, Wash., and P-1 and P-2 on Potholes East canal near Othello, Wash.
	Motor control switchgear consisting of one incoming power cubicle, four motor control cubicles, and one float switch for Ringold pumping plant.
Wyo.	Construction of 2,300 feet of 475-cubic feet per second capacity Means canal, enlargement of 6.5 miles of Eden canal to 300-cubic feet per second capacity, and enlargement of 150-cubic feet per second capacity Farson lateral, located 44 miles northwest of Rock Springs, Wyo.
a, Alaska	One 60-ton overhead traveling crane for Eklutna power plant.
ck, Mont	Power and distribution transformers, step voltage regulator circuit reclosers, and switching and protective equipment for Dawson County substation.
	Construction of 115/12.47-kilovolt Dawson substation at Glendive, Mont.
riz.	Construction of 28 miles of unreinforced concrete-lined Mohawk laterals and sublaterals of 120 to 15-cubic feet per second capacities, and appurtenant reinforced concrete structures, and removal of existing timber and concrete structures for Unit 1, near Roll, Ariz.
	Construction of 8 miles of unreinforced concrete-lined Mohawk canal of 135- to 30-cubic feet per second capacity, appurtenant reinforced concrete structures, and 8 miles of protective dike, near Roll, Ariz.
Valley, Colo	Construction of concrete cut-off and rock chute at Badger Wash, Book Cliffs soil and moisture conservation area, 20 miles northwest of Grand Junction, Colo.
Hungry Horse, Mont	Construction of three bridges on West Side Forest Service road, 30 miles southeast of Columbia Falls, Mont.
Kendrick, Wyo	Installing pumps and pipe for oil-handling equipment at new Casper substation.
Missouri River Basin, Nebr.	Construction of about 30 miles of laterals on the Cambridge lateral system near Arapahoe and Orleans, Nebr.
Missouri River Basin, Kans.	Furnishing and planting trees and shrubs for public use area at Cedar Bluff reservoir 18 miles southwest of Ellis, Kans.
Missouri River Basin, Mont.	One main control board, one annunciator relay cabinet, one 7,200/480-volt unit substation, one 460-volt and one 125-volt distribution board, and two 5-kilowatt battery chargers for Canyon Ferry power plant.
Missouri River Basin, S. Dak.	Construction of metal or concrete block warehouses and storage garages at Armour, Sioux Falls, Watertown, and Philip substations.
Missouri River Basin, Wyo.	Supervisory control and telemetering equipment for controlling Lovell and Thermopolis substations from Boysen power plant.
Do	Construction of water distribution and sewer systems for Kortes Dam Government community 63 miles southwest of Casper, Wyo.
Do	Construction of Shoshone River power 2,000-kilovolt-ampere substation near Cody, Wyo.
Palisades, Idaho	Construction of Palisades Dam and power plant on the South Fork of the Snake River in Bonneville County, Idaho, 7.5 miles southeast of Irwin, Idaho. Palisades Dam is to be an earth-fill structure about 2,200 feet long and 40 feet wide at the crest and 260 feet high. The 4-unit, 120,000-kilovolt-ampere capacity indoor-type power plant will be 64 feet high and 246 by 60 feet in area and will require construction of tunnel intake control and outlet tunnel discharge control structures. The substructure will be of reinforced concrete; its superstructure will have structural steel framing and either concrete or brick walls, or non-metallic side wall panels. A machine shop a d valve house, 280 by 40 by 35 feet, will extend west from the south end of powerhouse. Contract will also include excavation of 28-foot diameter spillway tunnel, 26-foot diameter inlets for power and outlet tunnels spillway and outlet tunnel discharge channels, and power plant tailrace; and lining spillway, power, and outlet tunnels and shafts with concrete.
Riverton, Wyo	Furnishing and applying asphalt lining on about 11 miles of Wyoming canal and Badger lateral.
Yakima, Wash	River channel improvement near Zillah, Wash.
Do	Placing buried asphalt membrane canal lining near Prosser, Wash.

United States Department of the Interior

Oscar L. Chapman, Secretary

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Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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FEATURE ARTICLES

SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1.50 a year for persons residing in the United States and Canada; $2 a year for foreign subscriptions; special rate of $1 a year for members of water users' associations, and Bureau of Reclamation employees.

OUR FRONT COVER

From Brushland to Butter

Four years ago the spot upon which "Genie" Wilbur, 4-year-old son of homesteaders Mr. and Mrs. Eugene C. Wilbur, is standing was barren sagebrush. Today the Wilburs are living comfortably on their farm in the Hunt Unit of the Minidoka project in Idaho. Mrs. Wilbur is justly proud of her attractive, modern kitchen with its electric refrigerator where she stores the soon-to-be-golden butter which Genie is helping to churn. *Photograph by Stanley Rasmussen, Region 1 photographer.*

35 YEARS AGO IN THE ERA

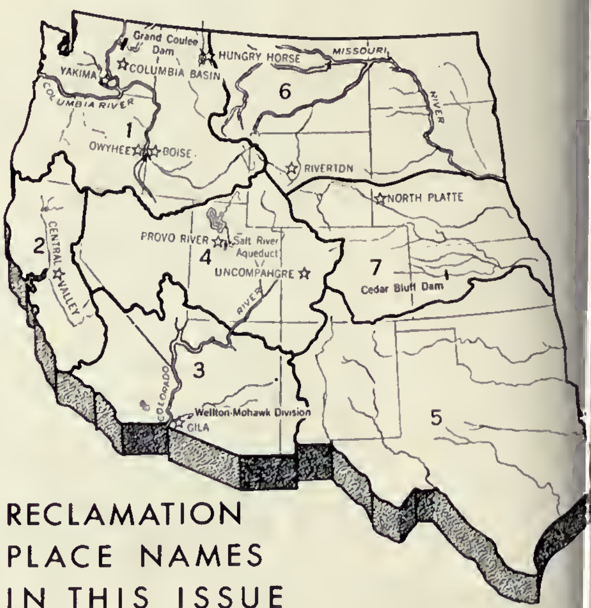
THE FARMSTEAD

Judging by inquiries being received from our farm regarding lay-out or plan of the farm buildings, orchar and yards, considerable interest is being taken in the i provement of the farmsteads, due probably to realiza that much is lacking toward making everything c fortable and convenient.

Some of our farmers have their farms and farmste planned and laid out in such manner as to afford most comfort and pleasure for the family, the most c venient performance of the "chores," and the most e nomical working of the fields and handling of the cr These well-planned farms should be given publicity the good of the cause, and to this end I wish every far who considers his farm scheme a good one would mak pencil sketch of same and send it to me. Out of th various ideas we will be able to develop the lay-out of ideal irrigated farm for each class of farming.

(From p. 87 of the February 1917 issue of the RECLA TION RECORD, predecessor to the RECLAMATION ERA.)

WE REPEAT THE INVITATION IN 1952!



RECLAMATION PLACE NAMES IN THIS ISSUE

QUAKES and CURRENTS

"TUNING IN" ON THE GROUNDWAVES—The operator of the seismic apparatus in the truck is learning of the subsurface conditions at the Low Gap Tunnel site, Columbia Basin project in Washington.

E. A. ABDUN-NUR, Engineer, and DAN WANTLAND, Geophysicist, Branch of Design and Construction, Denver, Colo.

MAYBE THE ENGINEERS' LATEST WORK in examin-g foundation sites for Reclamation structures is t earth-shaking news, but their techniques for vealing the earth's inner secrets through minia-e earthquakes and electrical currents are pay-g dividends in the construction of the Bureau's ter developments throughout the West.

These relatively new techniques for giving the rth's innards a quick once-over are known as ophysical explorations. By their use engineers n now determine the depth of foundation rock d the variation in its depth from point to point low the ground surface. They are also able to imate the extent, depth, and changes in thick-ss of gravel and rock deposits which are wholly partially buried below the surface of the ound.

Here's how it is done. Before Reclamation ructures are designed or built, geological studies e required to determine the natural site condi-ons and the problems these will bring to the signer and constructor. The site is mapped geo-gically to determine the quality of the foun-tion—how strong it is, how much it will pack down or compress, how watertight it is, how far down to sound rock, and how thick the overlying decomposed material is. In short, an inventory must be made of the foundation conditions before design and construction can proceed.

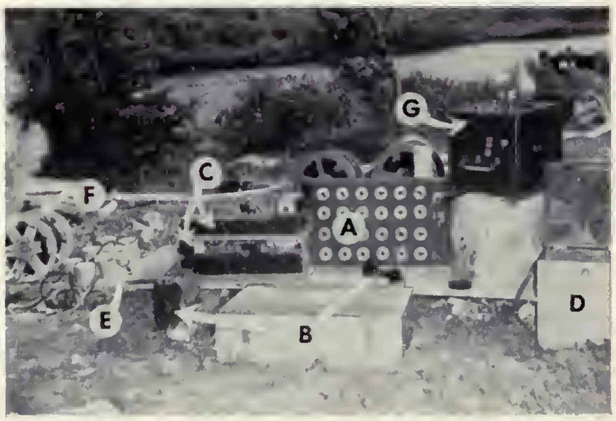
To expedite this inventory, Bureau engineers have adapted the methods developed by scientists who study the general constitution of the earth—methods which were later perfected by the petroleum industry in its search for oil beneath the surface of the earth. These procedures of studying the earth's anatomy, using the methods of field geology and laboratory physics (hence the name "geophysics"), give an over-all reliable picture of the underground conditions.

Geophysicists use a number of different techniques in solving engineering problems. Reclamation engineers have found two of them to be most useful in their preliminary investigations of water-resource projects.

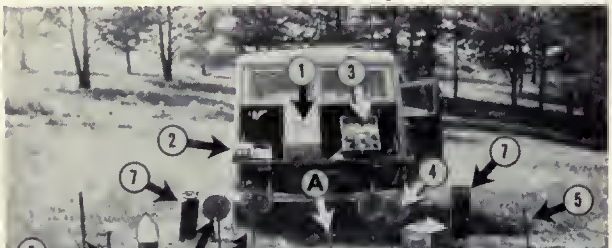
The first of these techniques, used principally to measure the distance from the ground surface to the top of the foundation rock, is known as the seismic method. With the seismic procedure, a miniature earthquake is produced by exploding a small charge of dynamite in a comparatively shallow auger hole. The waves produced by the explosion travel downward, reach bedrock, travel along it, and return to the surface where they are picked up by special microphones, called geophones.

The velocity of these waves varies with the different types of soil and rock in which they travel. The elapsed time between the detonation and the time a wave is picked up by the geophones is then measured. By relating this time of travel to the distance between the explosion point and the locations of the geophones, it is possible to calculate the depth to the bedrock surface.

The time and cost required to make seismic determinations are the same, whether the bedrock surface is at a depth of 20 or 300 feet. Because the

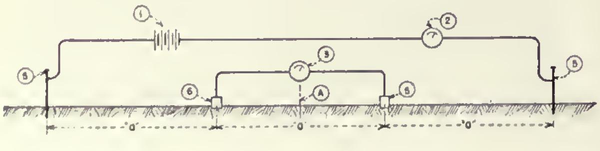


FOR PROBING THE UNDERGROUND—The geophysical equipment above was used to explore the Willow Park dam site in Wyoming: A—Attenuator, B—Field telephone, C—Amplifiers, D—Daylight developing box, E—Geophones, F—Reels, and G—Oscillograph and recorder. Below, the arrangement of resistivity apparatus for geophysical explorations.



(EQUIPMENT FOR MAKING FIELD ELECTRICAL RESISTIVITY MEASUREMENTS)

1. Battery-Power source	7. Water cans
2. Milliammeter	8. Copper sulfate solution
3. Potentiometer	9 Box for porous pots
4 Reels	"a" Spacing in feet
5 Field electrodes	A. Center of spread
6 Porous pots	



waves from the artificial earthquake travel along the bedrock surface for a long distance and are not reflected from one point only, the information gives a generalized subsurface picture that would otherwise require a great many drill holes to obtain. Only a few drill holes are necessary to provide the yardstick by which the seismic observations are controlled and correlated.

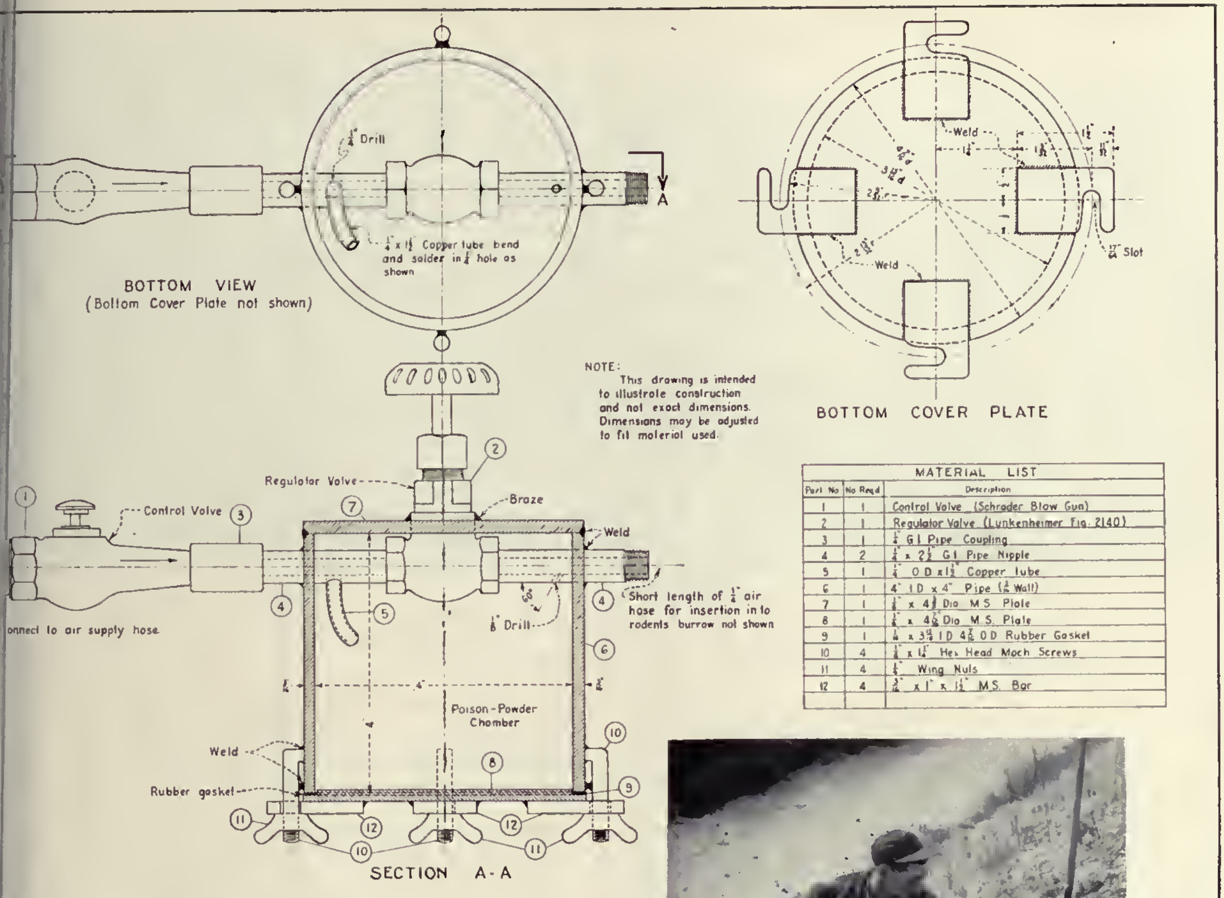
The seismic technique has a decided advantage over the usual exploration methods which require a large number of holes drilled at considerable expense and effort. Moreover, each drill hole, using standard methods, provides underground information at one point only, and the deeper the drilling, the slower the progress.

The second geophysical procedure, known as the electrical resistivity method, reveals the type of materials present, their wetness or compactness, and other conditions existing at the site. It consists of applying an electrical current, from portable batteries, to the surface of the ground through metal pins, and measuring the current and the drop in voltage between them. This permits the calculation of the electrical resistivity (resistance) to the passage of the current which in turn can be translated in terms of subsurface conditions existing at the site.

Similar to the miniature earthquake waves of the seismic method, the electrical current travels downwards and outwards and is therefore affected by a large volume of materials rather than by the conditions at one point. The resistivity method is fast and economical and can supply information either beneath a central point, which is analogous to drill hole data, or along a line at a given depth which is analogous to information obtained from digging a trench. Here again, the control has to be provided either through drilling, test pitting or by observations made on outcrops of the materials under investigation.

One of the many successful applications of the seismic method in Bureau work was the determination of the depth to bedrock in an old preglacial channel known as Abbott Gorge. This channel intersects the rim of the reservoir behind Hungry Horse Dam, now under construction in Montana. Here, initial geologic studies indicated that the channel was filled with glacial overburden of unknown thickness. For a time, the rock floor of the channel was believed to be below the high water level proposed for the reservoir. If this were s

(Please turn to page 41)



MATERIAL LIST		
Part No	No Reqd	Description
1	1	Control Valve (Schrader Blow Gun)
2	1	Regulator Valve (Lunkenheimer Fig. 2140)
3	1	1/4" G I Pipe Coupling
4	2	1/4" x 2 1/2" G I Pipe Nipple
5	1	1/4" O D x 1 1/2" Copper tube
6	1	4" I D x 4" Pipe (1/16" Wall)
7	1	1/4" x 4 3/4" Dia M S Plate
8	1	1/4" x 4 7/8" Dia M S. Plate
9	1	1/16" x 3 15/16" I D 4 7/8" O D Rubber Gasket
10	4	1/4" x 1 1/4" Hex Head Mach Screws
11	4	1/4" Wing Nuts
12	4	3/16" x 1" x 1 1/2" M.S. Bar

'hen William Adam Batzner (pictured at ht) figured out an easier, faster, cheaper way getting rid of gophers, he started something— ave of requests for photos, diagrams, and in- mation, some to be used in the Wall Street rnal, the Deseret News, Business Week, and

Gas Chamber for Gophers

er publications, and some from people who nted to know how to build the cyanide machine the rig for their gopher-fighting campaigns. en a District Agent from the Bureau of Preda- y Animal and Rodent Control in New Mexico, ed for more details to help him control pocket hers in Elephant Butte, Carlsbad, and other v Mexico irrigation districts.

Because of the widespread interest in this topic, e is a cross-section diagram of the chamber for cyanide powder which is forced by compressed into the gopher holes. A larger container will down on the number of times you need to replace the powder, and a clear plastic cover or container would make it possible for you to see when more is needed. Handling the cyanide powder is dangerous, and separately packaged charges for the gun would make the operation safer on windy days. For more information on how this device was developed and used with great success on the Boise project, read the article entitled, "Gassing the Gophers" by Hu Blonk on page 194 of the September 1951 issue of the Reclamataon Era.

The photo of Batzner, shooting the fumes into a gopher hole on a ditchbank, was taken by Phil Merritt, Region 1 photographer. The End.

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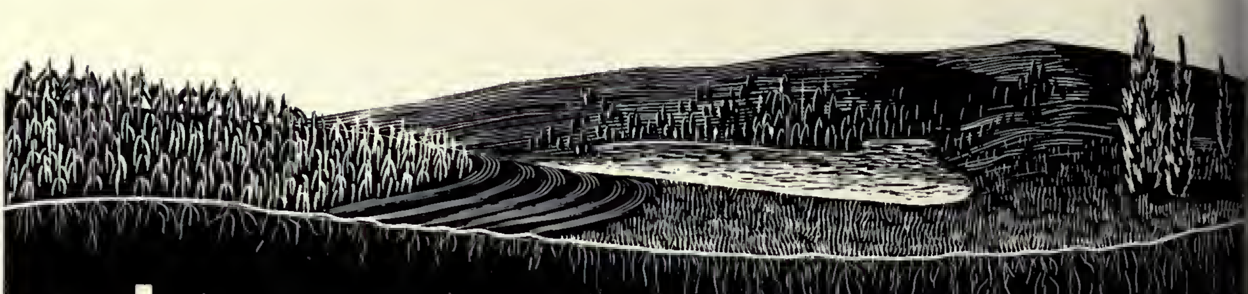


Elements in the Soil

by E. N. POULSON, Soil Scientist, and L. R. SWARNER, Irrigation Engineer, Region 1 Headquarters, Boise, Idaho

Part two in a series of articles on soils and land classification

DURING THE DEVELOPMENT PERIOD on Bureau of Reclamation projects, prior to assessment of construction costs, the soil productivity may be significantly increased under irrigation. It is logical that this productivity will be maintained by the same soil-building methods that were used to bring the soil to its present level of productivity. Actually most semiarid soils have an inherently high mineral fertility and acquire favorable organic characteristics under proper irrigation practice. They often have a potential productivity equal to, or in excess of, that of many soils found under more humid conditions where irrigation is not commonly practiced. Soil deterioration can result from many causes, such as the use of irrigation waters of unfavorable quality, or from poor drainage. On irrigated lands, depletion of the commonly low organic reserves may first become evident to a farmer by the slowing up of the intake of irrigation water. Especially is this true in a heavy soil, even if the soil is structurally normal at the start.

Sodium and Calcium

Sodium is the "poor relation" in soils. It has little significance in plant nutrition and is linked with soil structural deterioration, which results from soil dispersion or the running together of soil particles when wet. Under irrigation, a sodium-soil puddles and resists or almost totall excludes the penetration of both air and wate Plant growth is seriously retarded.

Fortunately, most virgin soils are not abno mally high in sodium. However, the use of so dium-bearing irrigation waters often promote excessive absorption of sodium by the soil. Stru tural deterioration also results from excessive u of irrigation water and the rise of ground wate These conditions may promote accumulations soluble salts in the soil, which are commonly calle "alkali." Two types of salts may be encountere The "salines" or "white alkali" include a hig proportion of the common table, Glauber, an Epsom salts. Washing soda and lye are the pri cipal constituents in true or "black alkali." T latter, as would naturally be suspected, are t most harmful in soils. Determining the advi ability of irrigating or reclaiming wet or alka land on proposed projects and evaluating t capacity of such lands to pay construction a operation and maintenance costs on existing pr ects is one of the major problems which confro Bureau of Reclamation personnel engaged in la classification.

Among the mineral elements that are soil co ditioners as well as plant nutrients, none has more complex role than calcium. On the oth hand none has so detrimental an effect on soil str

CCESS—OR FAILURE of on irrigation project depends upon the l. The authors (Poulson ot left, Swarner at right) inspect the ntents of o soil auger to determine in advance whether the rm might go out of production like those in the right panel: p photo shows saline and alkali soils, forming an irregular ttern across the field; center photo shows saline and high dium spots on which corn will not grow, and bottom photo ows neorly barren olkoli "slick spot" in an alfalfa field. ***Photo ove by Phil Merritt, Region 1 photogropher; photos ot right, urtesy of the United Stotes Regionol Salinity Loborotory.***

ıre and so little known value to plants as sodium lthough it is essential in animal nutrition. To a ırge extent, these two elements control or sigificantly modify the acidity or alkalinity of soils. s calcium decreases in the soils of humid regions, ıe acidity increases, and it becomes necessary to pply lime to reduce the acidity to a point favorble for crops. Calcium in the carbonate form radually becomes more plentiful in soils deeloped under increasingly arid conditions. Vhere rainfall is insufficient to accomplish much aching, the soils are alkaline, and lime and solble salts are often abundant.

In general, the best crop growth is made in oils approaching the neutral point; that is, lightly acid or slightly alkaline. Sodium proıotes a very rapid rise in alkalinity and creates oxic conditions limiting crop yields. Certain ıutrient elements are rendered unavailable to lants. An excess of lime may also render plant ıutrients unavailable.

Magnesium behaves to a large extent like calium in maintaining soil structure, but it is hought that, under certain conditions, too much nay be toxic to plants and cause structural deerioration. As a plant nutrient, it is believed to

(Please turn to page 34)

OSCAR G. BODEN—
Builder of Lifeline:

RECLAMATION'S HALL OF FAME
Nomination No. 12

by D. L. GOODMAN, Engineer, Design and Construction Division, Denver, Colo.

A LONG-TIME STALWART on Reclamation's all-star engineering team is gone. Oscar George Boden, one of the world's foremost authorities on canal construction who during his 40-year-long career of service with the Bureau of Reclamation built more canals and laterals than any other man in Reclamation history, died June 27, 1951, following several months of failing health.

Under Oscar Boden's determined and skilled guidance, thousands of miles of irrigation canals and laterals were built in the West, bringing new life and productivity to the sagebrush wilderness of Idaho, Oregon, and Washington, and the gaunt uplands of Nebraska and Wyoming. As construction engineer for the Delta Division of the Central Valley project in California from 1935 until his death, he administered the construction of such major features as the 120-mile-long Delta-Men dota Canal, the 48-mile-long Contra Costa Cana the Tracy Pumping Plant—world's second large pumping installation—and the project's vita artery, the Delta Cross Channel.

In recognition of such accomplishments, Mr Boden was awarded, posthumously, the Gol Medal award, the highest honor it is possible fo the Department of the Interior to confer.

Oscar Boden's 16 years of intensive work in th Central Valley was culminated in August, a littl more than a month after his death, when firs water flowed from the huge pumps of the Trac plant into the Delta-Mendota Canal and started o its long journey to the thirsty lands of the Valley Reclamation Chief Engineer L. N. McClellan speaking at the dedication of the Tracy pumpin plant on August 4, summarized Mr. Boden's Cen tral Valley achievements: "The irrigation work which Mr. Boden planned and built will remain

LASTING MEMORIALS to Oscar Boden's engineering ability are found throughout the West. One of the most spectacular is the Colossus-like Tracy Pumping Plant, below, its crane astride the pulsating "heart" of the Central Valley project. At right, the "assembly line" construction of the Delta-Mendota Canal, a new technique advocated by Boden.

sting memorial to his contribution to the de-lopment of the water resources of our country."

Oscar Boden came to California in 1935 at the quest of Walker R. Young, who at that time as the supervising engineer for the Central Valy project and who in later years was to become iief engineer of the Bureau. As the engineering ad in charge of construction of the Delta Divion features, Mr. Boden was one of the project's y engineering triumvirate which included Ralph owry, construction engineer of Shasta Dam, and . B. Williams, construction engineer for Friant am. Engineering administrator for this sphere f Central Valley activity, Mr. Boden was responble not only for construction of the Delta canal ructures and the Tracy pumping plant but for ie investigations, planning, and lay-out as well.

"Brig" Young's choice of Mr. Boden as one of is principal assistants was based on personal uniliarity with the latter's already remarkable cord of engineering experience and competence. Ir. Boden had distinguished himself as an agressive canal constructor on the Bureau's North latte and Riverton projects in Wyoming, on the ittitas Division of the Yakima project in Washigton, and on the Owyhee project in Idaho and)regon.

Harry W. Bashore, former Commissioner of Reclamation, was one of the first engineering adiinistrators to recognize Mr. Boden's ability. In letter written in 1925 in his capacity then as uperintendent of the North Platte project in Vyoming and Nebraska, Bashore said: "Oscar Boden secures permanent and lasting work at low cost principally on account of foresight and attention to details." Of Mr. Boden, H. D. Comstock, superintendent of the Riverton project (Wyoming) in 1925, wrote: "He is particularly successful in obtaining excellent results from contractors at low cost without friction. He is aggressive, dependable, and loyal."

Mr. Boden's Reclamation career began in 1911. His first 5 years of service were spent in operation and maintenance work as general assistant to the irrigation manager on the North Platte project. Although he was sometimes impatient with the relatively slow pace of maintenance engineering, he recognized the value of this early training, "The experience gained in this work," he wrote, "was of great help to me later on the location and construction of new works."

From 1916 to 1925, he was in charge of topographic survey work, lateral design and lay-out, and canal, drain, and lateral location of the Fort Laramie Division of the North Platte project. In addition to the construction of 50 miles of new canals and an equal number of miles of laterals, he was responsible for the location and construction of distribution systems covering 62,000 acres of irrigable land on the project.

From the North Platte project Mr. Boden transferred to the Riverton project where he remained for a year. In 1926 he was called upon to aid in canal construction on the Yakima project. He was reassigned to the Owyhee project in 1930 and placed in charge of construction of the project's

(Please turn to page 38)

PRACTICAL AND PROGRESSIVE were Boden's plans, and the structures built under his supervision reflect both aspects of his work. At left, the Contra Costa Canal headworks *(photo by B. D. Glaha, Region 2)*. Below, the Delta Cross Channel control structure *(photo by C. B. Hertzog, Region 2)*.

SHORT CUTS TO WEED KILLING CALCULATIONS

PART 9—Calibrating the Rig for Aromatic Solvents Applications

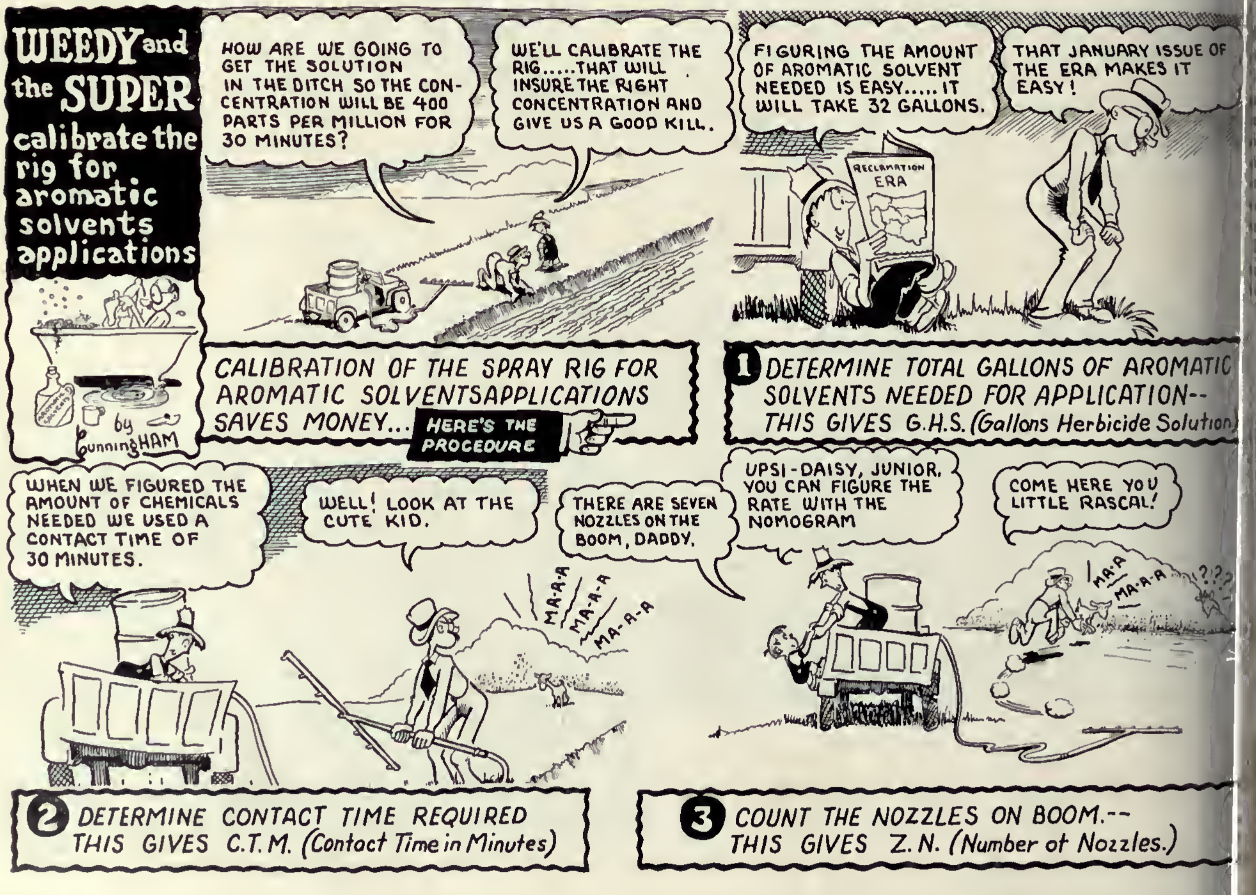
by JOHN T. MALETIC, Weed Specialist and Soil Scientist, Region 7 Headquarters, Denver, Colo.

Aromatic solvents is a new chemical used to kill waterweeds. Compared to other methods of waterweed control, this method is inexpensive. To prevent overuse of materials and to assure success of aromatic solvents applications, it is just as important to calibrate the equipment for waterweed control as it is for land weed control. This saves more money.

Part 8 of this series appeared in the January issue of the Reclamation Era. It showed how to determine the amount of aromatic solvents needed. Follow this first step with rig calibration to get correct amounts of chemical in the water. In the cartoon below, Weedy shows how it is done.

When calibrating, have several different size nozzles available. This is because the operating pressure needed to discharge the proper amount through one nozzle may be too low or too high for satisfactory operation. For accuracy, calibrate with aromatic solvents in the spray tank. At the same pressure, aromatic solvents discharge from a nozzle at a faster rate than water. To prevent waste, you should arrange to catch all the spray while measuring the delivery from a single nozzle. Remember—effective, economical use of aromatic solvents depends upon accuracy of calibration.

The End

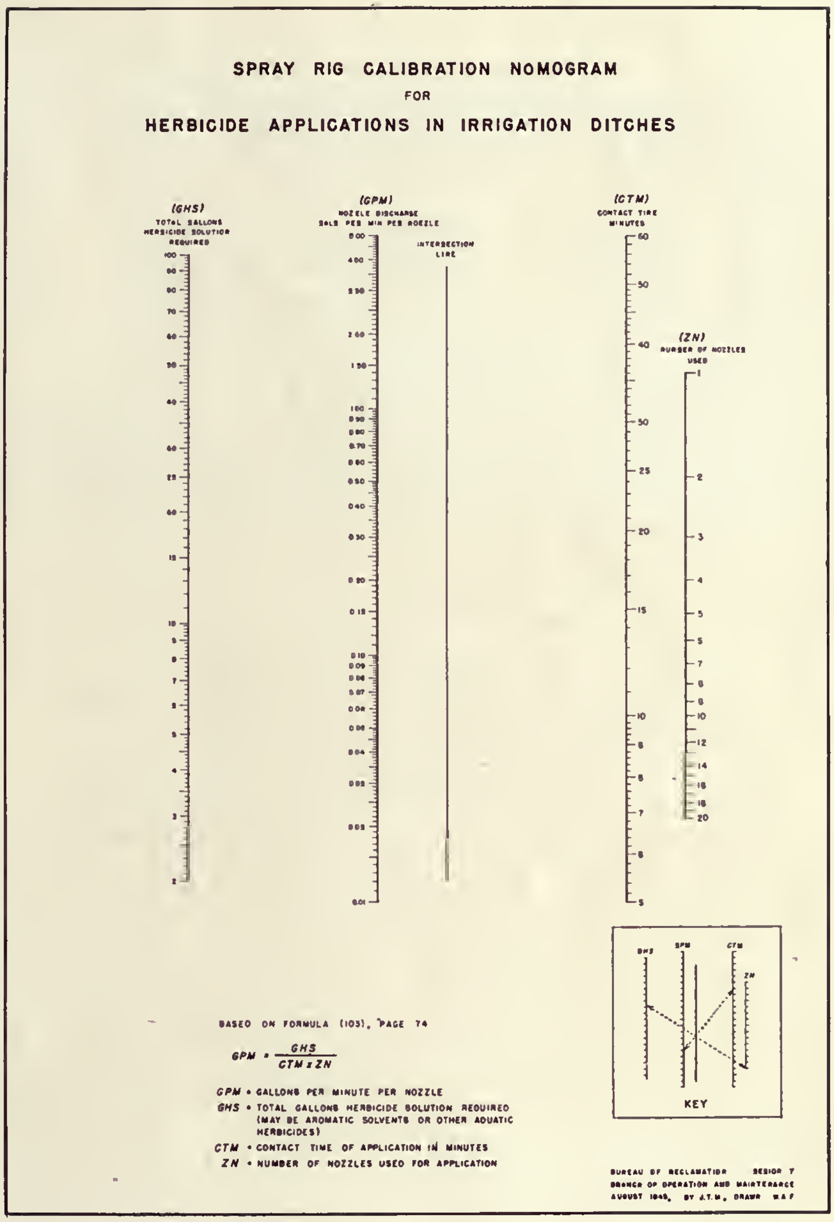


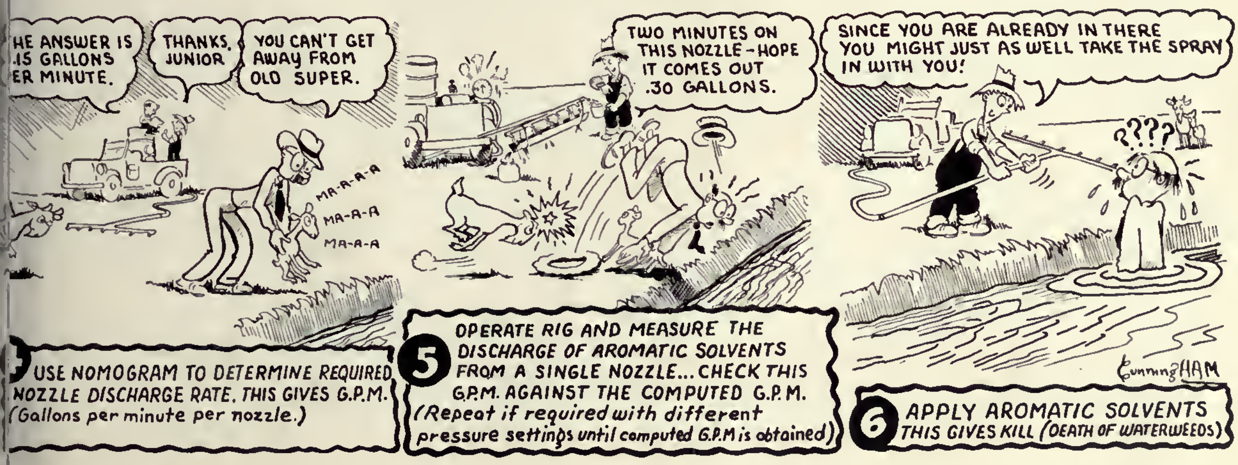
INSTRUCTIONS AND EXAMPLES

his chart will assist you rapidly and ly to determine the nozzle discharge needed to apply aromatic solvents. ives the gallons per minute (GPM) nozzle required to obtain a specified entration of the chemical in irriga- water. After obtaining this com- d GPM, the pressure is adjusted on rig until the measured amount ob- ed in 2 minutes from a single nozzle is oximately equal to the computed GPM. get the answer, simply connect the es with a transparent straightedge as vn by the dashed line in the key.

IRST STATION—For control of pond- d a concentration of 400 p. p. m. natic solvents applied over a period 30 minutes contact time (CTM) is rec- nended. If a boom with seven noz- (ZN) is used and the total amount romatic solvent needed is 32 gallons S)—what is the required nozzle dis- ge rate (GPM)? Connect 32 GHS 7 ZN. Mark the point where ightedge crosses reference line. Con- point with 30 CTM. Read answer 5 GPM.

OOSTER APPLICATION—When ap- ng aromatic solvents, a booster shot he chemical is frequently needed about miles downstream from the original lication point. If the booster shots to be applied with a 7 nozzle (ZN) m at a concentration of 300 p. p. m. a contact time of 30 minutes (CTM) uiring 24 gallons (GHS) of chemical— at is the required nozzle discharge (GPM)? Connect 24 GHS with 7 Mark point where straightedge ses reference line. Connect point 30 CTM. Read answer 0.11 GPM.





Elements in the Soil

(Continued from page 29)

be as important in the molecular makeup of chlorophyll, which gives plants their green color, as iron is in the red hemoglobin of the blood of animals.

SULPHUR which can be used to reduce alkalinity in soils, has an important function in the formation of protein in plants. There is a deficiency of sulphur in many of our western soils, particularularly in areas devoted to alfalfa—a high protein crop and undoubtedly the most important crop in Western agriculture.

Of the mineral nutrient elements that plants derive from the soil, none are better known than POTASSIUM and PHOSPHOROUS. Together with nitrogen, these are the major elements most often deficient in soils and are therefore the principal constituents of the more than 16,000,000 tons of fertilizers used annually in the United States. In plant growth, it is important that the nutrient balance of these elements be so maintained in the soil as to provide for a proper physiological balance in the plant. To a large extent, these elements support and supplement each other, which is important in fertilizer economy. Excessive use of one or two fertilizer elements is useless extravagance if the other elements are deficient or unavailable.

In our Western irrigated soils, potassium is seldom deficient and in many cases the availability is adequate for so-called "luxury consumption." The tone and vigor of plants is dependent on it and it exerts a balancing effect on both nitrogen and phosphorus. It is essential in starch formation, aids in chlorophyll development and has other functions important in such crops as sugar beets and potatoes grown so extensively under irrigation.

Phosphorus is not as plentiful as potassium, and in the West is often unavailable to plants in soils characterized by excessive lime or high alkalinity. Application of phosphate fertilizers on irrigated lands is more common than that of any of the other major fertilizer elements. Phosphorus is important in the division of cells during plant growth and in the formation of fat (oil) and protein. Flowering and fruiting are definitely dependent upon it, as is indicated by the large amounts found in seeds. Along with calcium, it encourages and strengthens straw, and increases plant resistance to disease.

In contrast to the heavy demands upon the major elements, there are a number of other elements, such as BORON, IRON, ZINC, COPPER AND MANGANESE, which are also essential for plant growth. All except iron occur in very minute quantities and are called minor or trace elements. The amounts present in soils often can be detected only by special laboratory tests. Deficiencies in soils are recognized by "deficiency diseases" of plants or the animals that consume the crops grown upon them, or by crop deficiency symptoms resulting from lack of or inadequate availability of these elements. Some of these elements are required only in amounts as low as a few parts per million of soil. In excess of this they are very toxic. Sometimes actual iron starvation or chlorosis may occur even though iron is plentiful in all soils. This is because too much lime or alkalinity or both make the iron and many trace elements insoluble and unavailable. This situation is especially common to soils in arid and semiarid regions. However, because of the minute quantities required, deficiencies are usually readily overcome by spraying the foliage, by small injections into the bark of trees or even by driving one or more metallic nails or tacks into the trunks.

Equally important to plant life is the air from which plants draw the elements of oxygen, carbon and hydrogen for formation of starch, sugars, and their woody or fiber structure. And, above all, without the soil water in which nutrients are dissolved and transported into and through plants and organisms, biological activities would cease and growth would not be possible. Plant and animal life diminish in more or less direct relation to decreasing moisture.

(NEXT MONTH—SOIL, WATER, AND AIR)

TATE ENTERPRISE AND GOVERNMENT PARTNERSHIP helped win the cle for freedom from salt invasion and water shortage. Mr. and Wayne T. Wright (above), prosperous partners on their Roll ranch.

PERSEVERING PRESIDENT of the Wellton-Mohawk Irrigation and Drainage District R. H. McElhaney and his wife (above). All photos for this article by S. B. Watkins, Region 3 photographer.

Water for the Wellton-Mohawk

Part Two—Farmers and the Future

A. B. WEST, Supervisor, Operation and Mainte-
nce Division, Region 3 headquarters, Boulder,
/, Nev.

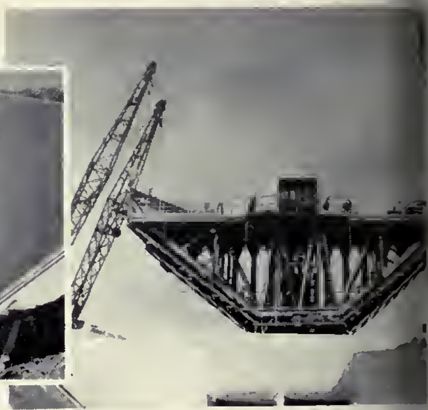
IcElhaney and his wife homesteaded 160 es near Wellton, Ariz., in 1924 and irrigated ir first 10 acres 5 years later. He was one of ozen homesteaders who settled in the valley at s time. The going was rough, and in 1926 he epted the foremanship of the Wright ranch r Roll, Ariz., to make ends meet. He held this until 1932. His undying faith in the valley uldn't let him pull up stakes. With his neigh-s he fought the drought and salt cycles, all the e improving his own ranch.

The Wellton-Mohawk area and Yuma County e the brightest future in the Southwest," he lares. "We're one of the few areas that will e an assured water supply. When we get sh water we will raise any crops that are grow- in the Salt River area or the Yuma area: small ins, cotton, alfalfa, hay, fruit, and vegetables, those general crops that are grown in our south-st desert areas. We are identical in growing son to the Yuma Valley and the Salt River lley. We average 253 frost-free days a year. spite of the poor quality water, several farmers produced cotton that yielded as much as two bales per acre last year."

Further proof that the Wellton-Mohawk Valley can grow the crops when it gets the water is seen on Wayne T. Wright's Antelope Ranch. Wright settled along the north side of the Gila River 3 miles southwest of Roll in 1925. From a small beginning he built up his ranch into one of the most prosperous in the Southwest. Although his irrigation water is some of the best in the valley, it is too salty for human or animal consumption. Fortunately, Wright discovered a vein of fresher water under his sprawling Spanish-type ranch house and sank a well to it. This furnishes palatable water for his household.

Like other farmers in the valley, Wright played along with the water instead of against it. Although his farming operations are perhaps the most diversified in the area, he has stuck mainly to alfalfa and Bermuda grass seed. This year, with the price of cotton high, he has planted as much acreage in that crop as his water supply would permit.

Wright has built up such a thriving seed business, complete with his own modern cleaning plant for processing, that often he cannot fill all the orders. Seed sacks with the Antelope Ranch



THE FIRST STRETCH—Check and turn-out for the first 8½ miles of the canal (above) and the Wash Siphon (at right). At extreme right, moving the lining machine over the Siphon.

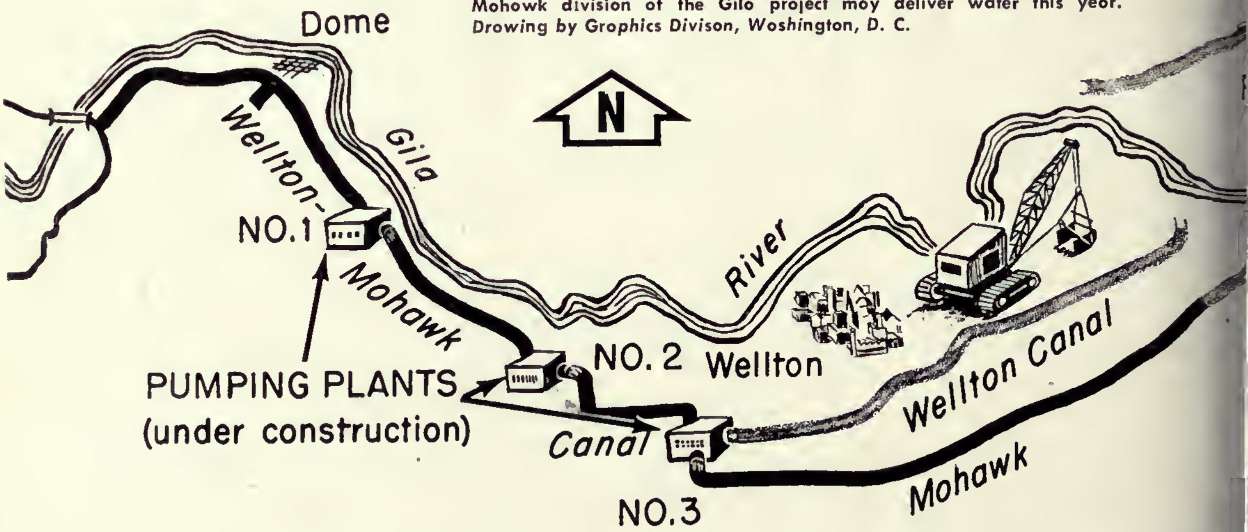
name printed on them are familiar brands in seed stores in the Middle West and North, particularly where the farmers require a seed that will resist bacterial wilt.

Wright has his own single-engine plane and landing strip. He parks the plane in a shed almost at his back door and takes off and lands with the same ease and convenience as when driving his automobile. The plane carries him to nearby and far-off places to talk with seed customers and attend alfalfa improvement and seed certification conferences, and on other trips.

Colorado River water will flow through the valley's irrigation ditches sometime in 1952. Hope for service in early 1952 is dimmed somewhat by flood damage last summer to a portion of the main Wellton-Mohawk Canal while under construction and by material priority problems.

The Wellton-Mohawk division's irrigation system consists of three major canals with appurte-nant structures, laterals, three main pumping plants, and two smaller pumping plants. The Wellton-Mohawk Canal. 18½ miles long, leaves the Gila gravity main canal at a point just below the Gila River siphon and about 15 miles below Imperial Dam. Its branches, the Mohawk an Wellton Canals, will carry the water to the later systems.

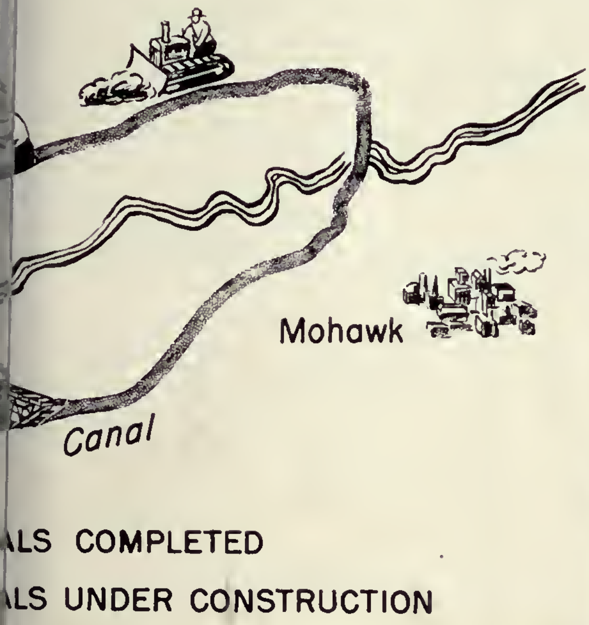
DIRT FLIES as the contractors use pick and shovel, bulldozer and derrick, and many other machines and engineering techniques so the Wellton-Mohawk division of the Gila project may deliver water this year. *Drawing by Graphics Divison, Washington, D. C.*



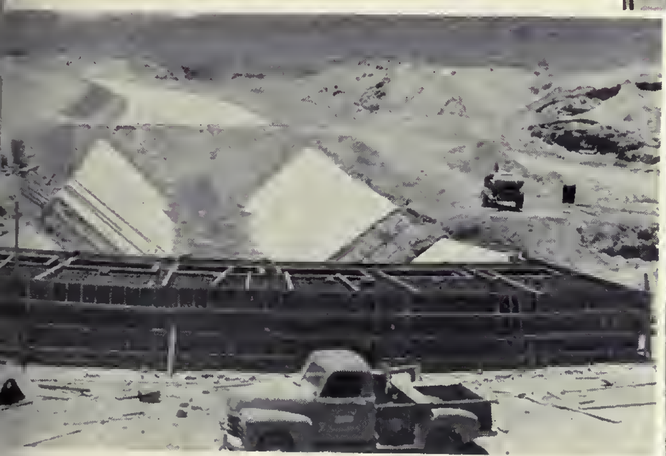
Work was begun on the first 8½ mile stret of the Wellton-Mohawk Canal by Fisher Con tracting Co. in August 1949. The Morriso Knudsen Co., Inc., built the remaining 9.9 mil of this main artery. Three large pumping plan along the canal which will lift the water a tot of 170 feet are being constructed by the Unite Concrete Pipe Corp. with pumps being furnishe by the Worthington Pump & Machinery Cor Western Contracting Corp. is building 29 mil he Mohawk Canal, and is also furnishing and alling radial gates for the Wellton-Mohawk nal. An additional 10 miles of the Mohawk nal is under contract to Marshall Haas & Royce. e remaining 5 miles of this canal will be started t spring. Morrison-Knudsen Co., Inc., is lding 12 miles of the Wellton Canal. Other tracts will involve principally lateral con- action.

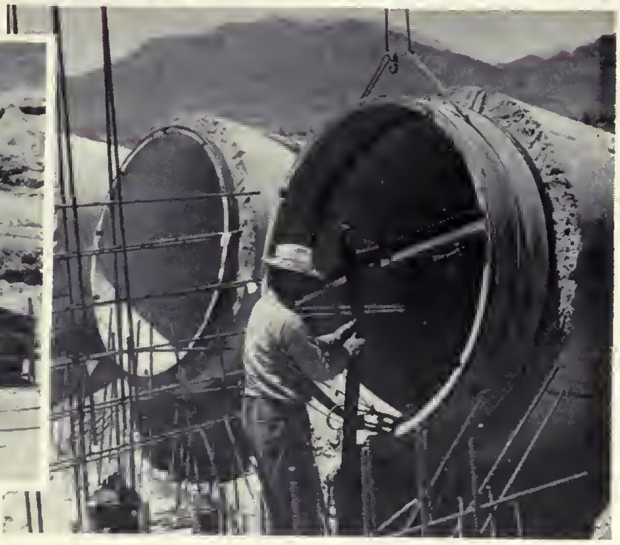
The three pumping stations that will lift the ter over the high places will be powered by rgy from Davis Dam, some 250 miles up the lorado River. The Wellton-Mohawk Irrigation l Drainage District will receive this energy at a substation near the No. 2 pumping plant. Besides the power used in pumping, the District will distribute energy to water users on the project. Profits from the resale of power will help offset the cost of pumping.

District President McElhaney regrets that the water on its way to the valley doesn't drop a total of 170 feet instead of having to be pumped that distance. Then the pumping plants could have been small power plants, producing (instead of consuming) electrical energy. But he's happy just the same, and explains that everything can't be perfect. Getting rid of the salt menace and adding acres of irrigated land are near enough to perfection as far as he and other valley farmers are concerned. THE END.



CLEANING UP the inside of a siphon under Highway 80 (top photo). At lower left, Pumping Plant No. 1 as it began to take shape last July. At lower right, on the same day, men were working on the discharge tubes for Pumping Plant No. 2.





Oscar G. Boden

(Continued from page 31)

major irrigation distribution system. Later he was given the responsibility of determining the location of the Black Canyon Canal on the Boise project in Idaho. He remained on the Owyhee project until his appointment by the Secretary of the Interior to start work on the first features of the Central Valley project.

Born in Kellogg, Iowa, in 1885, Mr. Boden was graduated from the Iowa State College as a civil engineer in 1910. He was employed as a surveyor's assistant on railroad location and construction work during the year following graduation. Married in 1912, he was the father of three children.

The son of a German Lutheran minister, Oscar Boden was brought up in an atmosphere of sincerity and probity. His later life as an engineering administrator typified his early upbringing. He was noted for his honesty and conscientiousness, and his impartiality in his relations with contractors and the Bureau working staff alike.

A practical engineer, he was a determined proponent of good quality in construction. Although of the "old school," he maintained a continued progressive outlook and was noted for his readiness to accept new techniques and improvements. His advocacy of the development of the huge 200-ton canal trimmers and lining machines on Central Valley canal work was notable in this regard. His associates remember him for his attention to detail and insistence on good workmanship. They recall that he would don high-topped "diggers" and walk along every mile of the canal or lateral that he was building.

Oscar Boden was a devoted family man, and his career came second only to his wife and children. He was noted for his keen sense of humor and his willingness to help others. While on the Owyhee project he worked after hours with his junior engineers, clearing off sagebrush near Nyssa, Oreg., to make a nine-hole golf course available for them.

For his record of achievements as a master canal builder, and for his outstanding role in constructing a large part of the more than 16,000 miles of canals that now bring water to far-flung areas of the West, Reclamation pays tribute to Oscar G. Boden by naming him as an inspirational leader in Reclamation's Hall of Fame. THE END.

CHEMICAL WARFARE AGAINST WEEDS is not new. About 40 years ago a scholarship student at the North Dakota Agricultural College, William H. Mercer, more familiarly known as Bil began experimenting with chemicals to contro wild mustard and giant ragweed in grain fields, thus shaping the pattern of his life work—weed-fighting. At that time he experimente with iron sulphate and other chemicals avail able at that time. Iron sulphate continued i use until several years ago when more selecti and effective chemicals were developed.

A pioneer from the beginning, Bill Merce was born 69 years ago in a sod-roofed log cabi in central North Dakota where his Civil Wa veteran father had pushed westward after h discharge from the Union Army. Bill grew u on his father's cattle ranch, leaving it in 19 to enter college, where he did so well in h studies on plant life that he was awarded scholarship in the Department of Biolog From that time until the present, with but on deviation, forced by the depression years, Bi Mercer's career has followed and helped shap the course of weed warfare.

Bill Mercer has long been in the thick of th weed fighting, and in following his career on can delineate the evolution of weed killing methods during the past 40 years.

In conducting any type of warfare, a soun military precept is to know your enemy. Fort years ago, Bill Mercer started his fabulou

40 YEARS

weed-seed collection, termed by many exper in the field as the best private collection of i kind. It now contains seed from many par of the world—Europe, South America, Alask and Japan, as well as North America. Th seeds are of many shapes and sizes, some tiny as to be almost invisible to the naked ey others larger than beans. Each seed-type preserved in a separate, carefully labeled gla vial. More than 500 of these thumb-size vial completely fill a large wooden case, speciall constructed by Bill to hold his collection. Th work of identifying weeds continues to be o great importance to farmers, and the intern

LIAM H. MERCER—ACE WEED-FIGHTER shown above examin- water hyacinth to see how it reacts to a newly developed ed killer. Mercer's work in this Bureau of Reclamation Weed itrol Laboratory in Denver is in cooperation with the Depart- nt of Agriculture's Bureau of Plant Industry. At upper right, rcer with his weed-seed collection, rated by experts as the best its kind. At lower right, the light-weight catamaran on the ompahgre project in Colorado in 1940 where hand-operated burners were used to eradicate ditchbank weeds.

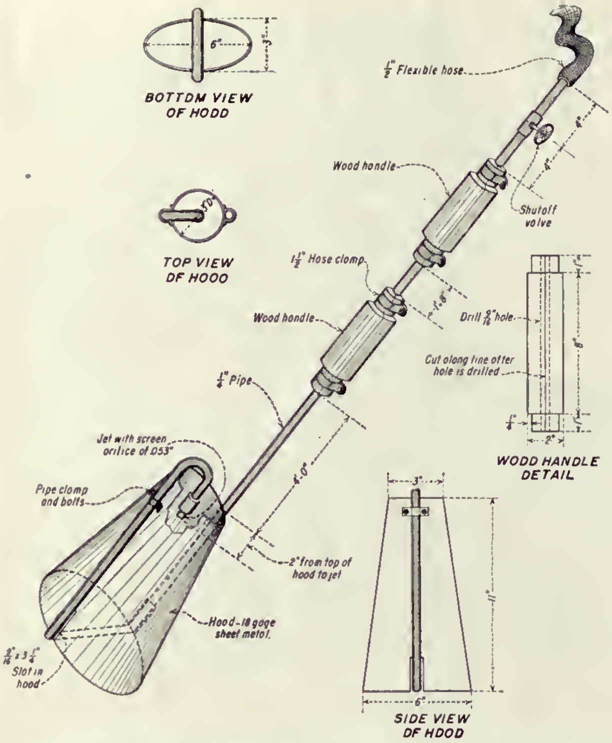
OF WEED-FIGHTING

onal character of Bill's collection reflects the owing interest and concern in foreign agriculre as it affects our own, particularly as weed eds and weeds have been known to travel great stances around the globe.

Bill believes in sharing his knowledge. While college he sold some of his writings to farm pers and magazines to help pay for his educaon, and continues to turn out interesting and luable articles on his pet subject. Readers of e Reclamation Era will remember his articles titled, "Tumbling Tumbleweeds" on page 225 the October 1947 issue, "Weeds and their orthy Opponent" on page 269 of the December 946 issue, and "Framing a Weed Control Program for the Uncompahgre Valley" on page 116 of the June 1938 Era.

The students in the Canby, Minn., high school were brought up to date on agricultural subjects by young Mercer at the beginning of his career, until he was lured back to his alma mater to serve as an assistant botanist, conducting laboratory and field experiments on controlling weeds, breeding and selecting plants, and analyzing seeds, besides lecturing and writing on weeds and their control.

Weeds by that time were becoming such a menace to farmers that legislation was needed to keep crop seeds free from weeds, guarantee State maintenance of public property to prevent the spread of weeds, and to control certain weed-killing prac-



PATENT APPLIED FOR—Mercer's invention, a hand-operated propane-butane weed burner, which can be built with a minimum of tools and shop facilities. ***Drawing by Marie L. Long, Branch of Design and Construction, Denver, Colo.***

tices. Mercer helped write North Dakota's weed and pure seed laws, pioneering in this field also. Later he gave similar assistance to Colorado, Texas, and Idaho when working in those States in later years.

As every farmer knows, there is no substitute for actual personal farm experience when dealing with the weed menace, and in 1917 Mercer began a 12-year bout with weeds on his own full-time farm located on the Uncompahgre project near Montrose, Colo., putting his scientific knowledge to the test. For his purposes, it was an ideal spot. When he joined the Bureau of Reclamation later, he surveyed the entire project and found that more than 33,000 of the 80,836 acres were infested with 10 different types of weeds, leading him to report that there were more weeds and more different varieties of weeds on the project than on any other comparable area in the civilized world.

It was in 1933 that he went to work for the Uncompahgre Water Users Association and the Bureau of Reclamation, serving in a part-time capacity with each until 1938 when he assumed full-time duties with the Bureau as a weed-control specialist, working on the Minidoka project in Idaho, the Rio Grande project in Texas and New Mexico, and at the Bureau of Reclamation's Regional office in Amarillo, Tex. In May 1948 he transferred to the Commissioner's Staff Offices in Denver, Colo., where he works in the chemical laboratories, devoting most of his time to testing the value of newly developed chemicals recommended as weed killers. If these chemicals actually kill weeds, then additional experiments are conducted to test the effect of the weed killer on farm crops. Miniature crop-raising and chemical-testing activities are carried out in two small greenhouses on a hillside behind the giant Engineering Laboratories building. These experiments are conducted in cooperation with the Department of Agriculture.

During the early days of his career, Mercer learned the names, shapes, strengths, and weaknesses of weeds, and began to devise the most effective weapons against each type, keeping in mind that crops, livestock, and soil must be protected at the same time.

Bill can remember when the only weapons against weeds—or "plants out of place"—were the 10 fingers of the hand, a hoe, a rake, or a fire. During his career he improvised several improvements on the mechanical methods for digging weeds out of the ground, dredging them from canals, or collecting tumbleweeds for eventual burning. With the growing interest in chemical control of weeds, and as chemicals become cheaper and easier to get, he continued his pioneering with new mixtures of sprays, dusting powders and solvents for waterweeds.

For the last 15 years Mercer has been conducting other tests to determine how long weed seeds will live in water and remain harmful if carried to fields in irrigation water. Some seeds remained fertile after being under water more than 3 years. Although results are still inconclusive, Bill has learned a great deal about under-water weeds and intends to write a technical paper on his findings.

Another of his contributions to weed control was his development of weed burners. Bill worked on and helped design a noncapsizable raft called a catamaran for weed-burning operations on the Uncompahgre project in Colorado in 1940, again pioneering the amphibious method of attack which later contributed in part to the building of a flame-throwing tank made from war surplus equipment. (See article entitled, "Building a 'Duck'" on p. 216 of the October 1946 RECLAMATION ERA.)

ck-mounted batteries of propane-burner heads e been used successfully for the past 2 years weed control on the ditches of the Las Cruces ision (New Mexico) of the Rio Grande project. se spectacular-appearing weapons still have a ce in weed control on irrigation systems both eliminating green growths on ditchbanks and dead plants at clean-up time. However, the elopment and use of more effective and eco-nical chemical weed killers has replaced many the burning operations used in the past. Bill rcer cautions against their use where wildlife ght be injured or nearby property or crops ght be damaged. When Bill Mercer reaches compulsory retirement age of 70 in March 1952, plans to devote much of his time to developing ew, small, hand-operated weed burner head. patent application on this device (illustrated p. 40) is now pending. This propane-butane ner is economical, light in weight, simple to nufacture and operate.

Even though Bill Mercer is retiring from the reau of Reclamation, he is not giving up his tle against weeds and his lifelong efforts have ped and will continue to help farmers to rid ir fields and ditches of these unwelcome in-ders.

THE END.

Quakes and Currents

(Continued from page 26)

reservoir would have leaked—unless the chan-l were blocked, involving expensive procedures. To determine the true depth of the channel, en-neers used a coordinated seismic and drilling ogram. Contrary to previous information, this rk demonstrated that the bedrock floor in the annel was, in fact, relatively shallow and actu-y at a higher elevation than the proposed maxi-um water level of the reservoir. Thus, the bed-ck floor is effectual in blocking the channel as a th of reservoir leakage. The cost of the work s much less than if the investigation had relied tirely on drilling. In addition, much time was ved.

The resistivity method has been used success-lly on a number of projects. For example, it s applied in the search for rock which would be itable for protecting the upstream face of Cedar luff Dam, near Ellis, Kans. Rock of this type which when broken into pieces is called "riprap") very scarce in the vicinity of the dam site area. ortunately, a small deposit was located at a distance of approximately 14 miles from the Cedar Bluff Dam site. The outcrops that were visible were not reliable for estimating the quantities that might be available. Because of the erratic and variable occurrence of the material, it would have taken a very large number of drill holes to provide an answer. Here, application of the resistivity method, supplemented by limited drilling and measurements of the outcrops, resulted in a speedy and economical estimate of the quantities of rock present.

THE END.

WARNE LEAVES INTERIOR FOR IRAN—Above, William E. Warne, former Assistant Secretary of Interior, receives a miniature Iranian flag from the late Dr. Henry G. Bennett, Administrator of the Technical Cooperation Administration, Department of State, during a luncheon at which Mr. Warne received a Distinguished Service Award from Secretary of the Interior Oscar L. Chapman (partially visible at right). Assistant Commissioner of Reclamation, Goodrich W. Lineweaver, master of ceremonies for the event, stands behind Dr. Bennett, who died in a plane crash December 27, 1951. Warne resigned from his Interior post on November 8 and in his new capacity will formulate and administer Point Four activities in Iran in cooperation with that Government. He will have the personal rank of minister and will be attached to the United States Embassy in Teheran. *Photo by Glenn Peart, Interior Department photographer.*

Spencer's Speed on Hungry Horse Pays Off

Clyde H. Spencer, construction engineer on the Hungry Horse project in Montana, received a $600-a-year raise in salary on September 5 for his outstanding contribution to efficiency, economy, and cash return to the Government in the construction of this project.

As a result of the excellent cooperation he has given the contractors, General-Shea-Morrison and the Grafe-Shirley-Lane Co., it is expected that the powerhouse will be ready to operate with the first generator several months ahead of the scheduled date—October 1952, thus bringing a quicker return to the Government on its investment in Hungry Horse. •

CVP Sets the pattern

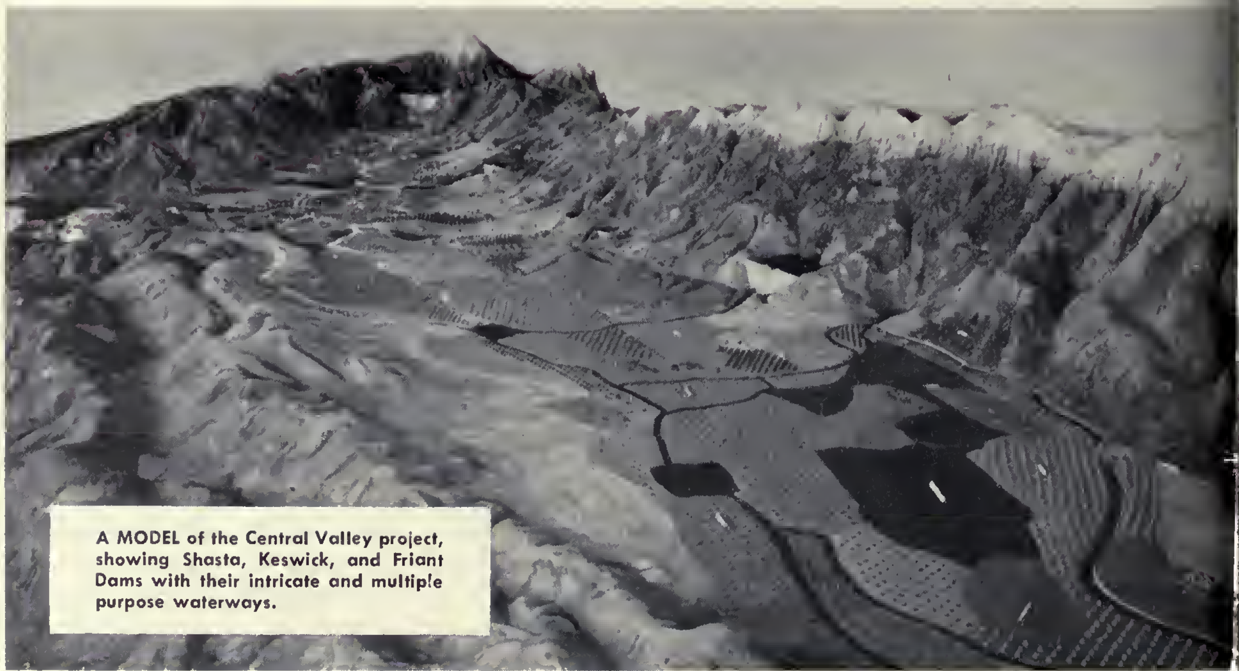
by SAMUEL B. MORRIS, General Manager and Chief Engineer, Los Angeles Department of Water and Power

Mr. Morris served the Nation as a member of President Truman's seven-man Water Resources Policy Commission which submitted its epochal report earlier this year. He was a principal speaker at the opening ceremony of the CVP Water Festival at Shasta Dam in August. In this article, based on Mr. Morris' Shasta address, he interprets the recommendations of the Commission in relation to multiple-purpose basin-wide developments like the Central Valley project. Photo at right courtesy of Berton Crandall Photographs, Palo Alto, Calif.

California long has been a leader in the development of bold yet soundly conceived water projects to move vast quantities of water from areas of plenty to areas of greater need. One of the first of these was the Owens River Aqueduct which transported water from the eastern Sierra 238 miles to Los Angeles. Then came San Fra cisco's Hetch Hetchy and East Bay's Mokelum projects. The All-American Canal and the Col rado River Aqueduct were additional great ste But nowhere in the Nation has there been a pr ect providing for such manifold uses of water the Central Valley project. It represents on grand scale the best example in the United Stat of multiple-purpose planning for all uses of t waters of a stream system.

Unfortunately, throughout the Nation the ma Federal agencies interested in water- and la use development have not been organized und the concept of such comprehensive multiple-pu pose development. Rather they have been orga ized under specific legislation to carry out singl purpose projects. Later legislation has attempt to expand their functions from their origi single purposes to the multiple-purpose program which modern day development requires.

Owing to the many diverse statutes governin the policies of the several Federal agencies, Pres dent Truman in January 1950 created the Pres dent's Water Resources Policy Commission an asked for recommendations for a comprehensiv policy for water-resources development. Th Commission completed its assignments by Fe ruary 1951 and issued its full report in thr volumes. This report may now be purcha from the Superintendent of Documents and m



A MODEL of the Central Valley project, showing Shasta, Keswick, and Friant Dams with their intricate and multiple purpose waterways.

YPICAL MULTIPLE-PURPOSE RIVER BASIN DEVELOPMENT. ders of the *Reclomotion Ero* moy remember o drowing similor e one obove which oppeored in the August 1949 (Woter Use Conservotion) issue of our officiol publicotion. Thot drowing so well received thot Shirley Briggs, Reclomotion ortist, wos commissioned to prepore the obove revision for the frontispiece of Volume 1 of the report of the President's Woter Resources Policy Commission, entitled "A Woter Policy for the Americon People." With the Commission's permission, we ore reprinting it here os o grophic illustrotion of wise conservotion ond use of woter.

be found in most libraries. It is a document that for the first time presents a uniform concept for the orderly conservation and development of our natural water resources, on which our entire future depends. I should like to express my understanding of the underlying philosophy of the President's Water Resources Policy Commission in drafting this report:

Water and land, properly husbanded, are permanent natural resources upon which the very life of our Nation and future generations must depend. Other mineral resources once consumed are no longer available, but water and land properly used are permanent assets. Because this simple but vital distinction has not been understood, we have seen the loss of much of our forests, fish and wildlife, and the serious erosion of soil caused by man's occupation of the land. We must continue to look to the private-enterprise system for the most efficient exploitation of natural resources. At the same time we must look to Government for the conservation of our natural resources, and most of all water and land. Natural resources and human resources are the source of the Nation's wealth and strength.

The Commission's recommendations are therefore not merely negative—that is, stating only that certain work should not be done unless certain standards of feasibility are upheld. Rather they are affirmative, declaring that action is required to conserve water and land for their best continuing use. The report cites the experience of the last two decades, beginning with the Boulder Canyon project and the construction of Hoover Dam and further exemplified by this great Central Valley project which clearly indicate that there is the greatest benefit and economy arising through multiple-purpose water developments. Such developments on our major rivers require comprehensive coordinated planning which takes into account the requirements of the entire river basin. To carry on such plans and programs adequately there is necessity for adequate basic data which should be continuously secured, compiled, and made available. Continuous studies are also required to develop the country's need for food and fiber and determine the proper timing of these great projects to improve the regional and national economy.

While the Commission outlined certain recommendations regarding return of costs it did not fully define standards of feasibility; rather it proposed a plan under which there should be stri accounting project-wise, basin-wise, and natio wise, covering cost of construction, operation, an maintenance, and capital including interest. I proposed the appraisal of benefits, both tangibl and intangible. It proposed that contribution t cost be made by all those benefited, including per sons, corporations, State and local government including irrigation districts, soil conservatio districts, drainage districts, special conservati districts, and the Federal Government. It is be lieved that such contributions to cost by all perso and agencies benefited would decrease the ki of log-rolling appropriations which all too fr quently are sought by those who benefit but pay n direct costs. It is believed that full, honest revel tion of costs and benefits, with no hidden subsidie would be an effective means of screening the de sirable from the undesirable projects.

To plan and program river basin water an related land use development, it was proposed th river basin commissions be created, representati of Federal, State, and local government. Oppor tunities for hearings in the field, and official com ments by State and local governments should in sure careful, well-drawn plans and properly ana lyzed programs. Creation of a board of review a the national level to review all such plans and pro grams, to aid in establishing uniform standards o feasibility, and to submit recommendations to th President and Congress, would be a further mean of assuring the undertaking of the best soundl conceived programs under uniform standards o feasibility. Finally, projects would only be au thorized by the Congress which, under our dem cratic process, would offer a final opportunity fo public hearings and public reaction on a Nation wide basis.

The general acceptance of these principles a guide to sound planning and development of ou national water resources will mean a long st forward in conserving and using without waste th great supplies of water which nature has given This mighty Central Valley project shows wh can be done, on a grand scale and with outstandi success, when the principles of multiple-purp river basin development are properly applie May it serve as a forerunner and a source of insp ration for the many great projects of the futu which will both save and use our land and wat and make America strong and an even better pla in which to live. The E

. G. & E. to Buy Central Valley Power

he Pacific Gas & Electric Co. signed a contract 1 the Bureau of Reclamation on October 3 for tral Valley power which is not needed by ference customers, including Federal agencies. ll Central Valley project power is now pro- ed at Shasta and Keswick Dams on the ramento River. The contract will permit the pany to purchase excess power also from Fol- and Nimbus Dams on the American River n it is available. This contract together with previous executed wheeling contract makes sible the delivery of firm power over P. G. &. ines to certain Bureau customers. Both con- ts terminate on April 1, 1961.

reviously P. G. & E. bought Bureau power er a day-to-day agreement. The sales agree- it establishes 300,000 kilowatts (or more than igh power for the city of Oakland, Calif.) as endable capacity for commercial use for the ent CVP hydroelectric power system.

nder the sales contract, the company is obli- d to purchase the remaining dependable unt of power after the demands for project rations and Bureau customers have been met. company will also purchase a large amount power on a nondependable basis at a much er rate. P. G. & E. will pay approximately same rate for dependable power as other omers.

yhee Project Turned Over to Water Users

rrigation farmers on the 100,000-acre Owyhee leral Reclamation project in Oregon started New Year of 1952 by taking over the operation maintenance of the network of 107 miles of als and 441 miles of laterals carrying water to project lands.

Jltimate operation of Federal Reclamation jects by the farmers themselves has been a damental policy of the national water con- vation program which enters its Golden Jubilee r in 1952. Altogether 76 projects or divisions projects constructed by the Bureau of Reclama- 1 are now being operated by the water users. The Bureau has operated the Owyhee project ce 1935 when farmers received the first water m Owyhee Dam and irrigation works. In the year interval, until the water users took over on uary 1, 1952, the area was being brought to l development and water was distributed on a tal basis.

BOARD OF DIRECTORS, SALT LAKE CITY METROPOLITAN WATER DISTRICT

Last month's issue featured the article, entitled "The Salt Lake Aqueduct," mentioning the members of the Metropolitan Water District of Salt Lake City as instrumental in providing an assured municipal water supply for the capital of Utah. Here they are, seated l. to r., Chairman George W. Snyder, S. A. Kennedy, and J. A. Nelson; standing, Treasurer Lane W. Adams and Grant M. Burbidge. Board member Blair Richardson was not present when the picture was taken.

Charles A. Bissell Retires With Honors

Charles A. Bissell, Regional Engineer for the Bureau's Region 3, retired September 30, 1951, after 34 years of service, for which he was awarded the Department of the Interior's distinguished service medal on September 28, 1951. J. P. Jones, his assistant since 1945, has been appointed acting regional engineer by Regional Director E. A. Moritz with whom Bissell worked when he joined the old Reclamation Service on the Yakima project in the State of Washington in 1908.

In 1911 Bissell became assistant engineer at Elephant Butte Dam, N. Mex., was appointed engineer in charge of the engineering section of the Washington, D. C., office in 1917, and in 1925 became chief of the engineering division. During 1930 and 1931 Mr. Bissell was senior engineer in the field service at large, in charge of field investigations undertaken by the Bureau in cooperation with the State of California which led to today's Central Valley project.

Between 1931 and 1939 Mr. Bissell was office engineer for the Metropolitan Water District of Southern California. Returning to the Bureau in 1939, he became assistant to the chief engineer in Denver, Colo., until his designation as Region 3's Regional Engineer in 1944.

Mr. Bissell was born in Navasota, Tex., September 11, 1881, where he attended grade and high school. He received a bachelor of science degree from Austin College in Sherman, Tex., and a degree in civil engineering from the University of Texas in 1906.

Brumback Rewarded for Rescue

Robert W. Brumback, Reclamation employee at Wellton, Ariz., received the Department of the Interior's distinguished service award on October 5 for saving the lives of a father and two sons from the Gila Canal.

A family from Florence, Ariz., had stopped on Highway 80 near Yuma. One of the family's two sons had fallen into the adjacent canal and his brother was attempting to rescue him without success. Brumback, seeing their distress while passing in his car, stopped just as the father was trying to rescue both boys. However, none of the family could swim. Brumback, fully clothed, dived in the canal, helped all three to a sand ridge, then called to his wife for a rope he had in the car. With the assistance of his wife and another passenger he pulled the trio out of the canal.

Not all such incidents have such a happy ending. The Bureau of Reclamation is interested in promoting safety in and around its projects. Learning to swim, having a safe place to swim, providing supervision for swimming places, and learning methods of artificial respiration are all part of this program.

Do you have any suggestions along this line? Do you know of a good safety slogan, or a story about a safety campaign that worked? Send your ideas, information, photos, drawings, etc., to your nearest regional director, or the Reclamation Era Office, *Bureau of Reclamation, Washington 25, D. C., whichever is closer. A free subscription to the* Era *for 1 year goes to anyone whose material is published in our official magazine.*

Alaskan Resources Report to Congress

Secretary of the Interior Oscar L. Chapman recently presented to Congress a "blue print" for Alaskan Resource development.

The report asserts in part that the development of Alaska is as important and vital to the United States as was the development of our Western States and that a balanced portion of the development must be in agriculture. It further emphasizes that this country as a whole needs Alaska's development from the standpoint of expanding its economy and, as individuals, the people need settlement opportunities, and other assistance necessary in connection with a frontier country.

Among the important topics treated in the report are the need for new hydroelectric plants, expanded agricultural production (estimated at a possible 87,000 acres), increased industrial and municipal water supplies, flood control and navigation of inland waterways (by both the Bureau of Reclamation and the Corps of Engineers), and the appropriation of sufficient funds to permit the efficient investigation of the territory's land and water resources. ●

Conant's Crystal Ball

Dr. James Bryant Conant, President of Harvard University and Honorary President of the Twelfth International Congress of Pure and Applied Chemistry, expressed the following comments regarding the future of solar energy and salt water conversion versus atomic energy, in New York City, September 5, 1951, as he described the world as it might appear in 1985.

The fine structure of the future is beyond the resolving power of my equipment. That I may as well confess. Therefore, the new scientific discoveries, the new theories, the various minor revolutions in physics and inorganic chemistry are not discernible. As to those major revolutions in biochemistry, which by 1985 has become the recognized successor to what was once called biology, these epochal events I need only allude in passing. What must be described are the slow but steady changes in the production of energy and food. The era of liquid fossil fuels is by the close of the century coming to an end, and the worry about future coal supplies is increasing. For reasons I will explain in a moment, atomic energy has not proved to be an expedient way of lengthening the period in which man taps the sources of energy stored in the earth's crust. Solar energy, on the other hand, is already of significance by the time the American Chemical Society celebrates its 100th anniversary, and by the end of the century is the dominating factor in the production of industrial power. The practical utilization of this inexhaustible source of energy, together with the great changes in the production of food, has already had enormous effects on the economic and hence political relation of nations. With cheap power the economical production of fresh water from sea water became a reality.

This was about 1985, and made more than one desert adjacent to a seacoast a garden spot. This last statement may seem to some of you altogether incredible. Let me, therefore, insert at this point a technical footnote, so to speak. You must understand that my apparatus which forecasts the future operates on a special principle. I feed into it certain ideas which might lead to revolutionary innovations at least in theory but are now regarded as impossible. The machine then scans the future decade by decade on the frequency of the idea in question. If the results were not at times surprising, there would be little use of such a piece of equipment, I am sure you as scientists will all agree. I might note parenthetically that it is an interesting fact that as regards the possibility of distilling fresh water from the ocean, no one has publicized the well-known fact that in theory the energy requirements are extremely low. For example, one gallon of gasoline provides on combustion somewhat more energy than that theoretically required to distill 9,0[illegible] gallons of fresh water from the ocean. (Notice I say "energy," not "heat," for as many of you are well aware it is mechanical energy that is required in the modern compression stills.) A corresponding theoretical figure which has been given wide publicity is the energy content of a few grams of Uranium 235 which are said to contain enough atomic energy to drive the *Queen Elizabeth* around the world. The one figure has perhaps as much relevance to future practice as the other. ●

WATER REPORT

he first time in several months
er report can be founded on a
l note and not be a dirge of
and short water supplies.
upplies in the West showed signs
good to excellent in all except
Grande and Arkansas River
and in parts of Oklahoma and
Even in the Rio Grande, run-off
close to normal and there is yet
r improvement in the Arkansas
Basin.

n by Region the outlook is as
:

on 1—Water supply uniformly
excellent. Run-off in the Snake
Basin is above normal. Above
run-off above Grand Coulee Dam
mbia River is in prospect.

on 2—Prospects for run-off are
Late January storms improved
ation in southern California.

on 3—Discharges of 77,000 acres
and 45,000 c. f. s. were reported
Verde River above Horseshoe
nd Salt River above Roosevelt
the Geological Survey. Reser-
r the Salt River project increased
acre-feet during the month with
more run-off expected during
y. Run-off was not high in the
Gila River Basin where the
t still persists. The drought ap-
is broken in southern Califor-
above normal run-off occurred
San Diego area. Expectancy of
in the Colorado River Basin is
normal.

on 4—Outlook for water is uni-
good. Run-off from Utah
s is expected to be above normal
in the southeastern parts of
Nevada run-off prospects are
as are those for Colorado and
ng.

on 5—This is the only region
generally poor water supply
ts. It still appears that early
water will be short in the Rio
and Pecos River Basins. Pre-
ion has been good on parts of the
Rio Grande Basin so the seasonal
may be near normal. Outlook on
cos River is not good for seasonal
Outlook for water on Altus
is good. It is fair for Tucum-
Run-off is subnormal in Texas.

on 6—Except for the Belle
e project which has fair pros-
the outlook for water is good to
nt throughout the region. Run-
North and South Dakota in gen-
much above normal.

Region 7—Run-off in the Platte River Basin is expected to be above average. Prospects are not as good in the Arkansas River Basin, where they are considered only fair. Run-off is above average in Kansas and Nebraska. ●

LETTERS

Warning on Waste

The following communication was recently received from M. R. Lewis of the Litani Technical Investigation Mission, Beirut, Lebanon. Mr. Lewis, previous to his Lebanon assignment, was chief of irrigation operations for the Bureau of Reclamation and has won wide recognition as an expert on this subject.

Professor Veihmeyer's article, "Don't Waste Water" in the November Era is excellent. He has presented clearly the importance of economical use of water and has pointed out many ways in which wasteful methods, now all too prevalent, can be corrected. A word of warning is necessary, however, in connection with his statement that, "Greater growth is not produced by frequent irrigations as compared to infrequent ones." As Professor Veihmeyer states, the irrigation schedule should be laid out in accordance with the moisture properties of the soil and the depth of rooting of the plants. The water available to shallow-rooted crops on soil with low water-holding capacities from a single irrigation is much less than that for other crops on soils with high water-holding capacities. The former will require more frequent irrigations than the latter.

Other experimenters have found that many crops do not grow as rapidly when the moisture content of the soil in the root zone approaches the lower limit of availability as they do when a more ample supply is present. These results, which appear to be in contrast to those reported by Professor Veihmeyer, may indicate the effect of different soils, different crops and different climatic conditions.

This comment does not in any way contradict the recommendation that water be applied only in the amount needed to supply the needs of the crops. It points up, only, the need for carefully considering crop needs rather than assuming that crops are all right so long as they do not wilt. ●

THE ADMIRAL'S COMPLIMENTS

The President's Committee
on Nationally Employ the
Physically Handicapped Week,
U. S. Department of Labor,
Washington, D. C., November 27, 1951.

Dear Commissioner Straus: Please permit me to compliment you and your staff on the excellent article titled "America Needs All of Us," which appeared in the October 1951 issue of The Reclamation Era.

We believe that there is no better way of acquainting employers with the abilities of the physically impaired than by pointing out successful work performance of handicapped workers. The article presents outstanding examples of persons who have relegated their physical impairments to the unimportant, insofar as their ability to do a top notch job is concerned.

We should like to give this article as wide circulation as possible. With this thought in mind, we have asked the Editor of the Reclamation Era, Mrs. Ruth Sadler, for permission to reprint the article in our monthly magazine, Performance, The Story of the Handicapped. Performance is circulated in both this country and overseas.

We appreciate your cooperation in helping us to break down some of the existing barriers to the employment of a large segment of our population who are being denied the full fruits of our way of life.

Cordially,

Ross T McIntire, M. D.
Chairman.

We appreciate the Admiral's comments, and look forward to reading the reprint of "America Needs All of Us" in Performance.—Ed.

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NOTES FOR CONTRACTORS

Contracts Awarded During December, 1951

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address
DS-3543	Kendrick, Wyo	Dec. 14	2 butterfly valves with operating mechanisms, control systems, and accessories for Alcova power plant.	Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.
DS-3548	Central Valley, Calif	Dec. 11	2 motor-control switchboards and 2 distribution switchboards for pumping plants E1 and E2, Exeter irrigation district, Friant-Kern canal distribution systems.	Lexington Electric Products Co., Inc., Newark, N. J.
DS-3550	Columbia Basin, Wash	Dec. 29	3 motor-driven, centrifugal-type pumping units for Upper Scooteney pumping plant, area P-2, Potholes East canal laterals, schedule 3.	Economy Pumps, Inc. Division of Hamilton-Thomas Corp., Philadelphia, Pa.
DC-3564	Kendrick, Wyo	Dec. 5	Construction of Alcova power plant and appurtenant works.	A. S. Horner Construction Co., Denver, Colo.
DS-3566	Central Valley, Calif	Dec. 4	5 lots of radio equipment and 29 mobile radio transmitter-receiver assemblies for additions to an existing installation in vicinity of Shasta Dam, schedule 1 except item 6.	Motorola, Inc., Chicago, Ill
DC-3569	do	do	Construction of 230-kilovolt Tracy switchyard addition.	George E. Miller, Long Beach, Calif
DS-3570	Kendrick, Wyo	Dec. 7	2 115,000-volt horn-gap switches and 3 115,000-volt disconnecting switches for Alcova power plant switchyard.	Memco Engineering & Manufacturing Co., Inc., Commack, Long Island, N. Y.
DC-3583	Columbia Basin, Wash	Dec. 11	Construction of Scooteney pumping plants and laterals, area P-2, Potholes East canal laterals.	Hunt and Willett, Inc., Wenatchee, Wash.
DC-3585	Central Valley, Calif	Dec. 27	Construction foundations and erecting steel towers for 20 miles of Folsom-Elverta 230-kilovolt transmission line, schedule 1.	James H. McFarland San Francisco, Calif.
DC-3586	Palisades, Idaho	Dec. 7	Open-cut and tunnel excavation and construction of construction substation for Palisades Dam.	J. A. Terteling & Sons, Inc., Boise, Idaho.
DS-3591	Columbia Basin, Wash	Dec. 28	1 motor-control equipment for Lower Scooteney (PE-27) pumping plant.	General Electric Co., Denver, Colo
DC-3606	Boise, Idaho	Dec. 12	Drilling drainage holes for Black Canyon Dam	Lynch Bros., Seattle, Wash
DC-3614	do	Dec. 21	(Negotiated contract.) Spillway rehabilitation of Black Canyon Dam.	Morrison-Knudsen Co., Inc., Boise, Idaho.
117C-123	Columbia Basin, Wash	Dec. 6	Fencing and protective structures	McWaters and Bartlett, Boise, Idaho
200C-183	Central Valley, Calif	Dec. 17	Furnishing or processing hauling and placing gravel, Station 4535+00 to 5185+50, Delta-Mendota Canal.	Vernon Dark
601C-19	Missouri River Basin, Wyo.	Dec. 10	Exploratory drilling for investigations of Hunter Mountain, Thief Creek, Bald Ridge, and Lower Sunlight Dam sites.	Mac Exploration Co., Garrison, N. Dak.
617C-24	Riverton, Wyo	Dec. 14	Buried asphalt membrane lining, Wyoming canal station 2560 to station 3131 and Badger lateral and wasteway.	Hicks Construction Co., Pinedale, Wyo.
617C-25	do	Dec. 17	Asphalt membrane lining, Pilot canal, station 943+00 to station 978+00.	Blacktop Construction Co., Billings, Mont.
703C-219	Kendrick, Wyo	Dec. 11	Construction of 12 two-bedroom residences at Alcova Dam Government Community.	Spiegelberg Lumber & Building Co., Laramie, Wyo.
703C-225	do	Dec. 14	Repairing overhead ground wires on the existing Seminoe-Casper 115 kilovolt transmission line.	The American Electric Co., Caldwell, Idaho.

Construction and Materials for Which Bids Will Be Requested by April 1952

Project	Description of work or material
Cachuma, Calif	Construction of Carpinteria reservoir and control station located northeast of Carpinteria, Calif. The reservoir is to be 25 feet deep and 270 feet square at the bottom with 1½ to 1 inner slopes. The bottom and inside slopes will be paved with concrete. The control station requires furnishing and installing chlorination equipment.
Do	Construction of Ortega reservoir and control station north of Summerland, Calif. The 60 acre-foot capacity concrete-lined reservoir is to be 20 feet deep with 1½ to 1 side slopes. The control station requires furnishing and installing chlorination equipment.
Do	Construction of Lauro chlorination and control house, an 18- by 65-foot concrete building with tile roof and open concrete pit for control valves, located near Santa Barbara, Calif. Installation of about 15 36-inch diameter valves and 1,500-feet of 54-inch diameter steel pipe, venuri meters, and other equipment for chlorination of 55 cubic feet per second of water for domestic purposes.
Central Valley, Calif	Three 3,000-ampere bus structures with current and potential transformers, lightning arresters, capacitors, and disconnecting and grounding switches; and 1 air circuit breaker for Folsom power plant.
Do	Two 7-cubic feet per second, 1 4-cubic feet per second and 1 2-cubic feet per second, all at 25-foot head, deep-well or propeller-type motor driven pumping units for pumping plant E-3, Delano-Earlimart irrigation district.
Colorado-Big Thompson, Colo.	Raising power and control lines from the ground and placing on poles southeast of Estes Park, Colo. Contractor will erect 23 structures and string messenger cable and hand power and control lines.
Colorado-Big Thompson, Colo.—Con.	Adding vibration dampers and armor rods to ove[rhead] ground wires on 23 miles Flatiron-Greeley, 2 Estes-Marys Lake, 13 miles Estes-East Port miles Flatiron-Brighton, 70 miles Brush-Lim miles Wiggins-Hoyt, 36 miles Brush-Sterling, 2 Brush-Wray, and 1 mile of Sterling-Holyoke mission lines.
Do	Construction of partially lined St. Vrain supply about 10 miles long of which 5 miles is design 625 cubic feet per second capacity and the rem for 575 cubic feet per second.
Columbia Basin, Wash.	Construction of 3 miles of distribution system 5 cubic feet per second capacity for part-time units in Block 41, lateral area E-2 on East canal, near Moses Lake, Wash., consisting of of precast-concrete pipeline with appropriate out structures to 55 part-time farm units, proximately 2 miles of 5 cubic feet per second wasteway for interception and conveyance of water.
Do	Construction of 0.6 mile of distribution system cubic feet per second capacity for part-time units in Block 49, lateral area P-1 on Potholes canal, near Othello, Wash., including appr turnout structures for 15 part-time farm units
Do	2 12.5 cubic feet per second at 40-foot head, 2 feet per second at 50-foot head, and 2 18 cubic feet second at 49-foot head horizontal-shaft, centr type motor-driven pumping units for pumping PE-60, PE-56, and PE-51, lateral area P-8.
Do	Construction of 20 miles of unlined laterals and ways of 180 to 2 cubic feet per second capaci irrigate about 6,000 acres in lateral area P-3 o holes East canal.

Construction and Materials for Which Bids Will Be Requested by April 1952—Continued.

roject	Description of work or material
Basin, Wash.—ued	Construction of 48 miles of unlined laterals and wasteways of 119 to 2 cubic feet per second capacities to irrigate about 18,000 acres in lateral area E–4 on East Low canal.
	Construction of the 236-cubic feet per second capacity, 4-unit, outdoor-type Ringold pumping plant on Potholes East canal, area P–8.
	Installation of two 65,000-horsepower, 720,000-gallons per minute pumps Nos. P5 and P6 in Grand Coulee pumping plant; and miscellaneous metalwork and electrical installation for Grand Coulee Dam pumping plant, and power plants.
m, Ariz	Supervisory control and telemetering equipment for ED–2 and ED–4 substations.
Alaska	Main control board, annunciator relay cabinet, station-service transformers, distribution board, battery control and distribution board, and battery chargers for Eklutna power plant.
, Mont	Construction of 115/12.47-kilovolt Dawson substation at Glendive, Mont., involving erecting steel structures, installing major electrical equipment, and furnishing and installing all other equipment; and construction of operation and maintenance and service buildings.
	Construction of 8 miles of unreinforced concrete-lined Mohawk canal of 135- to 30-cubic feet per second capacity, appurtenant reinforced-concrete structures, and 8 miles of protective dike, near Roll, Ariz.
Oreg.-Calif	Channel enlargement of the Lost River in Upper Langell Valley to improve the river course is to involve excavation of 6 miles of new channel to 4,000 cubic feet per second capacity and improving 1 mile of existing 4,000 cubic feet per second channel excavated under a previous contract, enlargement of 1 mile of 200 cubic feet per second capacity West canal, and construction of 2.5 miles of 35 cubic feet per second laterals. The work is located 50 miles from Klamath Falls, Oreg.
, Wyo	Two 15,000-volt switchgear assemblies with a 250,000-kilovolt-ampere interrupting capacity removable element or draw-out type air circuit breaker in each assembly; and 2 protective equipment cubicles consisting of potential transformers, lightning arrestors, and capacitors for Alcova power plant.
, Idaho	Construction of Palisades Dam and power plant on the south fork of the Snake River, 7.5 miles southeast of Irwin, Idaho, and relocation of 14 miles of State highway. Palisades Dam is to be an earthfill structure about 2,100 feet long and 40 feet wide at the crest and 260 feet high. This contract will also include excavation of 28-foot diameter spillway tunnel, 26-foot diameter
Palisades, Idaho—Con.	inlets for power and outlet tunnels, spillway and outlet tunnel discharge channels, and power plant tailrace; and lining tunnels and shafts with concrete. The 4-unit, 120,000-kilovolt-ampere capacity indoor-type power plant will be 64 feet high and 246 by 60 feet in area and will require construction of tunnel intake control and outlet tunnel discharge control structures and installation of embedded turbine parts. The substructure will be of reinforced concrete; its superstructure will have structure steel framing and brick walls. A machine shop and valve house, 280 by 40 by 35 feet, will extend west from the south end of powerhouse.
Do	Construction of permanent Government camp about 56 miles southeast of Idaho Falls, Idaho. The contract will include 20 three-bedroom temporary houses, 20 two-and three-bedroom permanent houses, 1 office building, 1 dormitory, 1 garage, and warehouse, one 12-car multiple-stall garage; facilities for 25 trailers; and streets, walks, sewers, and water mains.
Do	Four vertical-shaft hydraulic turbines each 39,500-horsepower at 190-foot head for Palisades power plant.
Missouri River Basin, Colo.	Construction of 3,000-kilovolt-ampere Julesburg substation.
Missouri River Basin, Nebr.	Construction of about 40 miles of laterals on the Cambridge lateral system near Arapahoe, Nebr.
Missouri River Basin, N. Dak.	Construction of 1,410-foot-long and 100-foot-high Jamestown earthfill dam on the James River will require 1 million cubic yards of earth fill, 1,700,000 cubic yards of excavation; and construction of spillway cut-and-cover conduit, intake structure, gate chamber and shaft, and shaft house and stilling basin.
Do	Construction of 2,500-kilovolt-ampere DeVaul substation, 11 miles southeast of Almont, N. Dak.
Do	Construction of 115-kilovolt, 750-kilovolt-ampere Fort Clark substation for Fort Clark irrigation unit in central N. Dak.
Do	Construction of 1,000-kilovolt-ampere Custer Trail substation, 8 miles southwest of Bismarck, N. Dak.
Missouri River Basin, Wyo.	Construction of 2,000-kilovolt-ampere Shoshone River power substation, near Cody, Wyo.
Do	Construction of water distribution and sewer systems for Kortes Dam Government Community 63 miles southwest of Casper, Wyo. The contractor is to excavate and lay 1,700 feet of clay sewer and wrought-iron pipelines; construct pump and chlorinator houses, septic tank, filter bed, well, and 20,000-gallon reinforced-concrete reservoir, install 2 pumping units, chlorinating unit, electrical equipment and materials, and place 4-foot diameter well tile.

United States Department of the Interior

Oscar L. Chapman, Secretary

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FEATURE ARTICLES

SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1.50 a year for persons residing in the United States and Canada; $2 a year for foreign subscriptions; special rate of $1 a year for members of water users' associations, and Bureau of Reclamation employees. No stamps, please!

OUR FRONT COVER

Desert Blossom

"A thing of beauty is a joy forever," and with this striking photo of the bloom of the Joshua Tree, we pay tribute to one of the Bureau's best photographers, William S. Russell, who died last spring. The desert-defying Joshua Tree marks the limit and extent of the Mohave desert in west-central Arizona, and although the greenish white blossom does not appear every year during the February to April blooming season, the tree furnishes food, shelter, and nest-building materials for small denizens of the desert, and gives up its small red roots to the Indians who use them to weave patterns in their baskets. Called *yucca breviflora* by the botanists, the Mormons named it Joshua Tree because it seemed, like Joshua in the Bible, to be lifting its arms in supplication.

35 YEARS AGO IN THE ERA

The occasional gathering of employees of t United States Reclamation Service to consid ways and means of improving work has preceden if a precedent were necessary—in the freque calling in by large business corporations of th important employees to acquaint them with t policies and aims of the corporation; to inject e thusiasm into the personnel of the corporatio and to encourage that cooperation between wor ers which is the basis of the success of big busine

On close consideration, a Government irrigati project is not unlike a great business corporati The water users on the project might well be cal the stockholders in the corporation; the proje manager is the business head of the institutio and the Government makes the regulations wh control the workings of the business in the sa manner as the Nation and the States control operations of corporations.

From article entitled "The Purpose of Operat and Maintenance Conferences" by I. D. O'Donn Supervisor of Irrigation, on page 107 of the Ma issue of the RECLAMATION RECORD, predecessor the RECLAMATION ERA.

RECLAMATION PLACE NAMES IN THIS ISSUE

ETS IN THE SNOW are ferreted out with a sampling tube ve). Surveyors use various means of transportation over snow courses (inset). *Both photos by the Soil Conservation ice, United States Department of Agriculture.*

WITH A FINGER ON THE PULSE of arteries like this one (Moore's Creek, Boise River, Idaho), the forecaster determines the run-off for the irrigated areas of the West. *Photo by Phil Merritt, Region 1 photographer.*

FORECASTING SPRING FLOODS

ROBERT W. GAY, Supervising Hydraulic Engineer Region 1 headquarters, Boise, Idaho

The October 1950 issue of the RECLAMATION A carried an illustrated feature entitled, ived—More than Five and a Half Million llars." The story explained how $5,600,000 flood damages had been prevented on the lumbia River and tributaries during the spring od crest by the control of flood waters at 13 reau of Reclamation reservoirs in the Pacific rthwest. The flood control operations were co-dinated with the flood control measures of the rps of Engineers.

The total represented damages averted by con-l of flood waters at Grand Coulee Dam on the lumbia River in Washington, at three reser-irs in the upper Snake River Basin in Idaho, o reservoirs in each of the Boise and Fayette ver Basins in Idaho, and five reservoirs in the kima River Basin in Washington. These ervoirs constitute the bulk of storage space w available in the Columbia River Basin.

Behind this feature is a story—a story which rted over 50 years ago when a scientist named A. Mixer cut cylinders of snow, melted them, d measured the water they contained. Since at time, hydrologists (those who deal with the ence of water, its properties, phenomena and tribution over the earth's surface) have con-ued to improve what we now call "snow surveys" until nowadays they are used to help forecast spring floods which result from the melting snow.

Another side of the story behind the news of the multi-million-dollar saving in Columbia Basin flood damages, is that of the increasing importance of using irrigation reservoirs for multiple purposes. Not so long ago, an irrigation reservoir superintendent's only concern was to fill the reservoir before the irrigation season started, regardless of how much surplus water flowed over the spillway. In recent years, however, damaging floods, water shortages, and a growing realization of the need for conserving and using water to the utmost, have brought about attempts to develop and use the flood control possibilities of irrigation reservoirs, along with recreation, fish and wildlife preservation, power development, silt control, and other available benefits.

In the Columbia Basin, the reservoir operators work as a team with the Corps of Engineers, the Soil Conservation Service of the United States Department of Agriculture, the Weather Bureau of the Department of Commerce, and other cooperating agencies, with the objective of holding enough water in each reservoir for irrigation, or irrigation and power, releasing enough to make room for the expected floods, and keeping in mind the effects such releases will have on the rivers and reservoirs below.

ACCURATE FORECASTING keeps Arrowrock Reservoir (at right) at just the right level for serving the Boise project and reducing flood losses like that of the Columbia River flood of 1948 (below), through efficient coordination of operations at other Reclamation reservoirs in the Pacific Northwest. *Photo at right by H. W. Fuller; photo below by Stanley Rasmussen, both Region 1 photographers.*

The key to the entire complex operation is the seasonal flood forecasting system, which enables each reservoir operator to obtain advance information on how much flood water must be handled.

The spring run-off of most northwestern streams is the result of the melting of snow accumulated during the winter, plus the rainfall occurring during (or shortly before) the flood season. Not all of the water in the snow or rain will eventually reach the flood flow. Some will evaporate. Some will be consumed by plants, or held in the soil. Some will percolate down through the soil to become part of the groundwater.

The hydrologist must determine how much water, either from melting snow or from rainfall will find its way to the rivulets and streams, to mingle with, and add to the dimensions of, the spring flood.

Fortunately for the hydrologist of today, preparation for spring flood forecasting as well as other run-off reports and forecasts often begins before a dam is completed. Long before the reservoir is ready to hold any water, hydrologists, mathematicians and engineers are busy studying its watershed, and devising a forecasting procedure to be used when construction is completed. They gather, evaluate and test the data that have been and will be available, the physical characteristics of the watershed, how to allow for variations in soil moisture, how much rainfall occurs during the spring, the temperature of the area, evaporation, methods of operating the reservoir, and innume- able other things which go into a forecast.

During the fall and winter months, the fo- caster is busy collecting background data, a planning in advance for the day he will receive the pieces of the puzzzle, so that he will be able convert the mass of reports into information abo the volume of the spring flow.

In the fall of the year, provisions and equi ment are cached away in the snow survey cabi located far in the isolated mountains. Some these cabins are equipped with "Santa Claus chi neys," steeplelike structures to provide entran even when the cabins are buried by gigantic sno drifts. If it were not for these shelters, the sno survey crews would have to carry heavy loa of food and equipment as they follow the sno courses on foot, on horseback, on snowshoes, sk in automobiles, or special snow vehicles. The tri may take a few hours or several days.

Once at the sites of the snow survey courses, t surveyors locate the same spots which previo surveys have shown to give a representative i dication of the snow depth and water conte They then take a hollow, pipelike tool, and bo it down through the snow to the solid groun From the markings on the tube, they learn t depth to ground level. They then pull the tu out of the snow, weigh the snow-laden tube a determine the weight of the snow and thus t weight of the water. Sheaves of data from t frozen snow courses become important parts the mosaic which is fitted together to form t pattern of the future flood.

By mutual agreements, in most of the weste es, the Soil Conservation Service of the Dement of Agriculture makes the surveys, or nges to have them made.. The Weather Bu- compiles rainfall records as a part of its nal responsibilities. However, for the pur- of flood forecasting, some additional gages been installed. A few gaging stations even the data by radio or telephone wire to the g office.

he forecasters thus are ready for spring fore- like that which helped hold the 1950 flood heck.

spring flood, to the hydrologist, is not a mat- of water rushing downhill, it is a complex blem of adding, substracting and converting ewhat odd bits of information into a predic- of things to come.

t the end of each month, by mail, telephone, type, radio, and messenger, the latest reports snow cover, soil moisture, rainfall, reservoir age and other related facts are fed to the fore- er. With his working graphs, charts, slide , facts and background material, he makes his ort and forecasts the water supply. And he t do it quickly if it is to be of value.

he hydrologist makes his first forecast, usually ing the first week in April, based upon the data piled as of April 1st, and predicting the vol- of water to be expected between April 1st and y 30. Forecasting is not an exact science, but practically all reservoirs, there is a range of wers which will serve for practical purposes yet permit floods to be reduced and the reser- r to be refilled.

Accumulated snow and past rainfall can be measured at the given spots, but tomorrow's, next week's or next month's snow or rain cannot. Periodic new forecasts can be made to permit reservoir operation to be modified if necessary.

Again in May a forecast can be made of the expected flow during May, June and July. Each month the chances of error are less, as more of the spring run-off becomes a matter of record, rather than calculation. Another forecast is usually made during June and July. By the end of July the stream flow has usually dropped to a near normal, marking the end of the forecast period.

The number of forecasts required varies in different localities. Only one forecast may be sufficient during a year of low run-off when the reservoir will obviously be able to retain much more water than it will receive. However, these same conditions might require even more careful forecasting procedures in order to indicate how stringently water-saving measures should be employed to avoid serious water shortages.

Through the medium of the various interagency committees, and by cooperative studies, the various governmental agencies are exchanging ideas and working together to improve the hydrologic work of all agencies. The West-wide spring forecast published in the May issue of the RECLAMATION ERA each year, the West-wide water report published in the fall, and the brief Water Report appearing in other issues, are examples of the results obtained through this cooperation.

THE END.

Shasta's Flood Control Job

hasta Dam, during the storms of December 1 and January 1952, gained 130,000 acre-feet storage as a result of a torrential rainfall hin 24 hours. At times the inflow exceeded 00 cubic feet per second, which if added to the er channel at Red Bluff, Calif., would have n critical. Releases from Shasta Dam during s period averaged only 3,700 cubic feet per ond, necessary for power generation. The od crest of 143,000 cubic feet per second in the ramento River at Red Bluff on December 27, 1, was almost entirely the result of 50-year ord peaks on streams flowing into the river ow Shasta Dam.

Due to misunderstandings over the functions of Shasta Dam during periods of flood danger, the Bureau of Reclamation's Acting Regional Director R. S. Calland issued a statement pointing out that Shasta was doing its job in controlling floods, and should not be held responsible for flood crests which occurred below the dam. •

Moore Repeats Presidency

John S. Moore, former Reclamation official now retired, was re-elected president of the Washington State Reclamation Association at the annual meeting of the Association early in December 1951. •

NEXT MONTH!

Special Columbia Basin Issue

How the project began; what has been done and what is now being built, and how the new Chief Engineers—the Columbia Basin farmers—are putting the water to work.

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CATTLE AND CROP PRODUCTION flourish in the Pacific Northwest under proper sprinkler irrigation practices. *Photos by Morris Hodge, Portland, Oreg., submitted through the courtesy of the author.*

ALUMINUM AND SPRINKLER IRRIGATIO

by JOSEPH T. KING, Counsel for the Association of Sprinkler Irrigation Manufacturers

THE SUCCESSFUL APPLICATION OF WATER to thirsty crops through sprinkler irrigation systems has become an important phase of irrigation farming in every section of the country. The reports from neighboring farmers about the saving of water, the saving of precious top soil, and the consistently high quality of their crops probably started you thinking and figuring as to how sprinkler irrigation can better your operation. The sprinkler test plots at the experiment station or information from your County Agent have given you plenty of good sound advice as to the best method of handling cropping programs under sprinkler irrigation. You have spent the winter gathering your information and planning for next season's crops to be sprinkled.

Has it occurred to you that maybe you won't be able to get the sprinkler system this year? Well, maybe it won't be you, but it might be the fellow across the road or the one that joins your place on the north. Perhaps you wonder why. From the reports you have read in the papers, it sounds as if aluminum production is being increased, and you may think that plenty of aluminum may be available for the sprinkler equipment that you plan to install this spring. But—let's take a look at the over-all picture of aluminum and what it is being used for.

Before the outbreak of hostilities in Korea, t annual production of aluminum in the Unit States was about 750,000 tons annually. Pla are progressing at the moment to increase th production to about 1,250,000 tons annually. B there will be precious little increase by the ti you need your sprinkler equipment this spri The Defense Production Authority has the sponsibility of dividing this huge amount aluminum each quarter along with the other c trolled materials, copper and steel. First, course, the requirements of the military alo with other highly essential programs such as Atomic Energy Commission, and the Defe Electric Power Administration are assigned proximately 50 percent of the total supply. remaining 50 percent must be split between classifications of civilian production. Out of t remainder must come automobiles, trucks, refr erators, radios, cooking utensils, sporting goo farm machinery and the many items you use your daily lives. Your sprinkler irrigation eq ment is part of this latter group. Pots and pa for example, use as much aluminum under controlled materials plan as does sprinkler rigation.

During the fiscal year ending July 1952, th will be approximately 148,200 acres of land in t coming under Bureau of Reclamation water the first time. Of this acreage, the largest le project is the Columbia Basin project of shington where, it is estimated, there will be roximately 65,650 acres for which water will be lable. Much of this land plus thousands of s of farm land from coast to coast will come production this year under the controlled urg- of sprinkler irrigation.

nce the end of World War II, the land under nkler irrigation has increased at the rate of percent per year. But this year, because of shortage of aluminum, such increase will not possible. Will you be among those unable to y out your well-calculated plans because the pment is not available? In the second quar- of 1952, because of the operations of the Con- led Materials Plan, there will be only about percent of the sprinkler irrigation equipment duced as was manufactured in the same quarter 950.

ach year, whether or not equipment produc- is normal, many farmers are not able to get r equipment as early as they need it because have delayed too long in making the neces- arrangements. Remember that investing in nkler irrigation equipment is not as simple as ing a new tractor. The equipment must be ially designed for your farm to fit your soil cropping program. This takes time and the of a capable technician who completely un- stands sprinkler irrigation. There are usu- such men available to your area through reli- e machinery outlets.

he sprinkler irrigation industry is relatively , but today it is ready to serve your needs ex- t for the shortages of material. The shortages luminum will have an adverse impact on farm duction, water conservation, and soil conserva- .

o make the most of the equipment you have, get erts to help you design your sprinkler opera- ns, get your orders in early, and bear with us ing these difficult times.

he Secretary of the Interior, the Secretary of riculture, the Commissioner of Reclamation, l the industry have your welfare in mind and doing the best they can to make certain you get r rightful share of materials. Some action has eady been taken toward enlarging the alloca- ns of aluminum for sprinkler systems, based on importance of maximum food production to this country's welfare and the increased yields made possible through proper use of sprinkler irrigation. The allocation of aluminum to the sprinkler industry for the second calendar quarter of 1952 is slightly above the amount allocated for the first quarter. However, because the second quarter demand is normally the greatest, the increased amount set aside for the industry falls far short of meeting the need. Unfortunately, many people do not realize the essentiality of this type of farm machinery, and the vital role it plays in agricultural production, and in soil and water conservation. THE END.

Three-Way Tunnel Job At Eklutna

Three firms and three adits characterize the Eklutna job at this stage of its construction. Working through an Alaskan winter, about 200 employees of Palmer Constructors (a three-firm organization of Peter Kiewit Sons, Coker Construction Co. and Morrison-Knudsen Co.) and the Bureau of Reclamation have made a good start in boring the 4½-mile-long, 9-foot-diameter tunnel which will pierce Goat Mountain and carry water from Eklutna Lake to a power plant on the Knick Arm side of the mountain at tidewater.

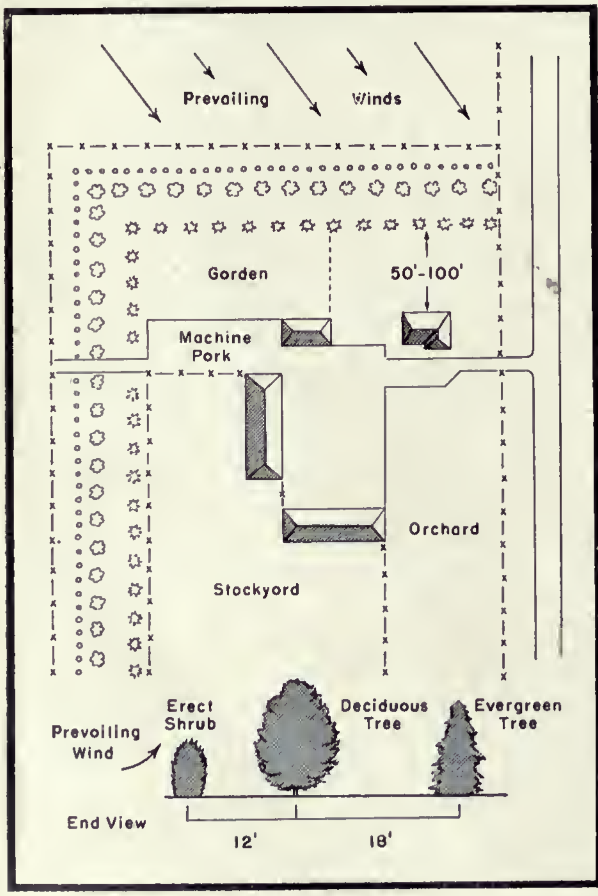
According to Joseph M. Morgan, District Manager of the Alaska District Office in Juneau, the contractors have already constructed their own auxiliary powerhouse, heating plant, mess hall, and barracks, and are holing through the tunnel from three adits. The crews sank a 200-foot-deep shaft into the mountain, 1100 feet from the shore of Eklutna Lake. By the middle of January they were drilling in two directions, and had bored 60 feet toward the lake and 90 feet toward the other side of the mountain. On this side of Goat Mountain the cullings (or excavation materials) are lifted up the elevator in the 200-foot shaft. At the Knick Arm (or power plant) end of the tunnel, where the crews began to drill toward the Lake side of the mountain, the materials can roll down the slope where the 1,250-foot penstock for the power plant will be constructed. The weather has averaged 35° below zero but within the tunnel it is just above freezing temperature.

The $17,348,865 contract for the transmountain diversion tunnel and other facilities was awarded in September 1951, the contractors starting work on the 1050-day job on October 11, 1951. •

Windbreak Plans for Irrigated Areas

EDITOR'S NOTE: This represents only one of the thousands of items that a new settler should know as he moves onto the Columbia Basin project in Central Washington. With the permission of the Institute of Agricultural Sciences at the State College of Washington, we are reproducing this section of chapter F on "Tree Plantings" one of the 25 chapter headings for the "FARMERS HANDBOOK for the Columbia Basin project" which begin with Chapter A–1 entitled "What Kind of a Farm Should I Develop?" and wind up with Chapter Y–1, entitled "Your Community."

Three agencies (the Soil Conservation Service, the Extension Service and the Bureau of Reclamation) collaborated on the following article, such collaboration being typical of the contents of the Farmers Handbook. In addition to the Soil Conservation Service and the Farmers Home Administration, which played especially important roles in the preparation of a number of the Handbook sections, the following agencies made significant contributions in the work of compiling and reviewing material: The State of Washington's Department of Agriculture, Department of Conservation and Development, and Department of Health; the United States Department of Agriculture's Bureau of Agricultural Economics, Bureau of Plant Industry, Soils and Agricultural Engineering, Farm Credit Administration and Production and Marketing Administration, and the Interior Department's Fish and Wildlife Service. The Handbook itself was printed by the Agricultural Extension Service of the State College of Washington, and will not be generally distributed other than by specific request because of the cost of preparation.



Plan at least a 2-row windbreak. The shr row should be planted on the windward side give protection while evergreen trees are getti established. Shrubs and evergreens can planted fairly close to irrigation ditches.

RECOMMENDED SPECIES

2–row windbreak

Windward row—any of the following:
- Southernwood
- Russian Mulberry
- Bladder Senna (colutea)
- Caragana

Second row—any of the following:
- Norway Spruce
- Blue Spruce
- Douglas Fir
- Austrian Pine
- Ponderosa Pine
- Scotch Pine

3–row windbreak

Windward row—any of the following:
- Southernwood
- Caragana
- Russian Mulberry
- Bladder Senna (colutea)

Second row—any of the following:
- Black Locust
- Green Ash
- Russian Olive
- Norway Spruce
- Douglas Fir
- Austrian Pine
- Ponderosa Pine
- Scotch Pine

Third row—any of the following:
- Norway Spruce
- Blue Spruce
- Douglas Fir
- Austrian Pine

Wildlife plantings (Contact the Washington ate Department of Game for assistance):

Bladder Senna (colutea)
Snowberry
Southernwood
Multiflora Rose
Black Locust
American Plum
Russian Mulberry

ow fences and shrub rows:

Caragana
Bladder Senna (colutea)
Southernwood
Russian Mulberry

PREPARATION FOR PLANTING

The plan: lay out the planting area so that the ature trees will give the desired benefits.

WINDBREAK PLANTINGS

Use at least two rows.
Plant at least 50 feet from nearest building.
Locate the planting so that it will break the prevailing winds.
Space rows 12 feet apart or more; adjacent broadleaf and evergreen rows should be at least 18 feet apart.
Plant shrubs 3 feet apart in the rows—except Russian mulberry, which should be 6 feet.
Plant trees 12 feet apart in rows—except Russian olive, which should be 8 feet. The slower growing evergreens, spruce, juniper and arborvitae, can be planted with 6-foot spacing and thinned out when trees reach competitive size.
Plant trees at least 15 feet from lined irrigation ditches. Locate plantings so that they will not interfere with irrigation practices.

PREPARATION OF GROUND

Work the ground the fall before planting by plowing and leaving rough. Cultivate shallow in spring to level site and kill weeds. Apply rotted barnyard manure before plowing, if available.

OBTAINING PLANTING STOCK

Trees and shrubs are available at low prices from the Federal-State Forest Tree Nursery, the State College of Washington, Pullman, Washington. Price list-order blanks can be obtained from County Extension Agents. Place your order early.

PLANTING INSTRUCTIONS

1. Plant trees as soon as possible after receiving them. Keep the tree bundles moist and protect from exposure at all times. If trees are not planted immediately upon receipt, the bundles should be opened and the trees heeled in and well watered.

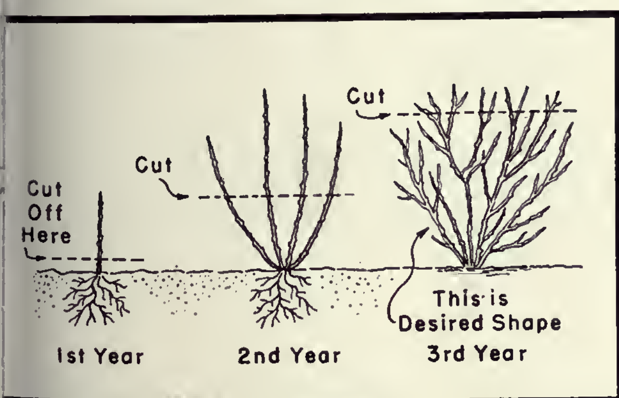
2. Keep roots covered and moist at all times during planting by keeping them covered with wet burlap or in a bucket of water.

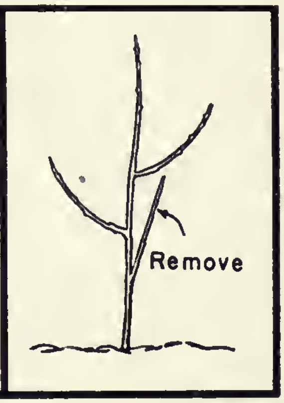
3. Line out the planting area and mark places for individual trees before starting to plant.

4. Plant trees one at a time, using a mattock, spade, or irrigation shovel. The hole dug should be large enough to take the roots without bending or cramping.

5. Set the plant not more than 1 inch deeper than it was grown in the nursery to allow for settling of the soil. Natural depth can usually be easily determined by difference in bark color. Tramp the soil firmly around the roots; settling the soil with water during planting is well worth the extra effort.

(Please turn to page 58)





MORE WATER for MORE PEOPLE

by EDMUND G. BROWN, Attorney General of the State of California

Attorney General Brown is a member of the California Water Project Authority and a key figure in dealing with the water problems of the State. This article is based upon Mr. Brown's address during the CVP Water Festival at Redding, Calif., in August, 1951.

The completion of the initial features of the Central Valley project is certainly a reason to rejoice and to take justifiable pride in the works of man. But the works of man, unlike the works of God, are not perfect. One of the paradoxical things about the CVP is that although we have been able to solve its stupendous engineering problems, we have not yet successfully solved all the legal, social, economic and political problems, left in the wake of the engineering. I am speaking of the political problem in the largest sense—that is, the relationship between local, State and Federal governments in the operation and control of the project.

In trying to find a solution, I have found rather than a solution, something more in the nature of an approach that may some day lead to a solution. We are at the brink of a tremendous adventure in the conservation of resources. It is not given to any one man to see where all the paths into the unknown may lead. If we have faith, however, in the American way of life, faith in government based on the free and objective discussion of ideas, I believe we can face this adventure unafraid and full of confidence that our ultimate solution will provide the greatest good not only to us in California but to everyone in the Nation.

Applying this faith which I most firmly have, I have adopted the following immediate policy for the Attorney General's office of California in dealing with our water problems:

It is our object to get as much water for as many beneficial uses, as quickly, as inexpensively, and for as many people as we can.

To this end, I have and will continue to use all the facilities of my office to negotiate with the Federal government, to advocate or oppose legislation and to conduct litigation to achieve our goal. You will notice that I put litigation as the last item. This is deliberate. Litigation produces little water except the litigants' tears and the lawyers' perspiration, and these are salty and not much good. I believe that much more can be accomplished by treating each other as men of good will and trying to solve our problems in the spirit of amity and mutual respect, than by crossing swords and dealing at arm's length in court.

Of course, litigation is sometimes inevitable. In the Central Valley it is inevitable. This is because the law requires that the contracts between the Bureau of Reclamation and the various water districts be declared valid by an appropriate court. In this litigation, those dissatisfied with the contracts have attacked them on the ground, among others, that the State laws which authorize them are unconstitutional. They have urged me to join in this attack. Of course, I have refused to join because it is my job as Attorney General for the State and its people to try to establish the constitutionality, not the unconstitutionality of State laws. But there is another and equally fundamental reason why I have refused to join this attack; this is because the attack is actually an attack on having the Bureau of Reclamation in this State at all. This is a political rather than legal problem, and while I feel a good deal of sympathy for increasing the State's share of control of the project, I see no way now of reaching any good result by litigation. So, I take the ition that the contracts offered by the Bureau valid under State law.

Similarly, there is a great deal of talk about nership of water rights—talk carrying the sinr connotation that somehow the Federal Govment is going to deprive us of our water. In first place, such talk is not legally sound; the ited States by its own laws has to get its water hts in the same way as any private person, that nder the conditions fixed by the State Engineer ording to California law. I have found no one he State or Federal Government who feels that State Engineer's authority will not be fully ctive. In the second place, there is the pracl consideration; the best way for the Federal ernment to get paid for its investment is to p on delivering the water. Finally, there is physical problem; as our own United States strict Judge Oliver Carter once said:

IT IS INCONCEIVABLE THAT THE PHYSICAL WORKS THE CENTRAL VALLEY WOULD, AT THE END OF THE YEAR PERIOD, BE ROLLED UP AND TAKEN ELSEERE.

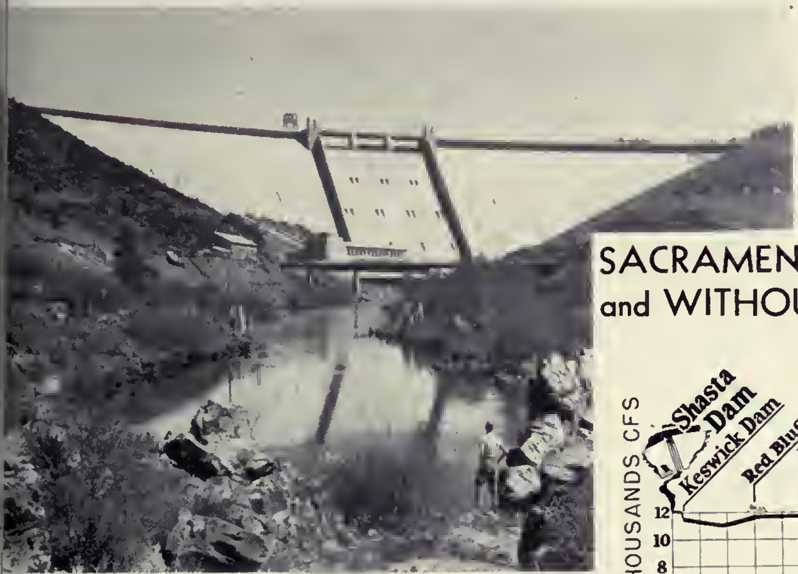
Our rivers must not waste idly to the sea while conduct a debating society. We all can't rase it as beautifully as Mr. Justice Holmes, t I think we all feel it:

A RIVER IS MORE THAN AN AMENITY, IT IS A TREASURE. IT OFFERS A NECESSITY OF LIFE THAT MUST BE RATIONED AMONG THOSE WHO HAVE POWER OVER IT.

The recent CVP celebration was like a college commencement—it represents more of a beginning than an ending. The Central Valley illustrates what can be accomplished on an even grander scale. We have the imagination to see the possibilities. We have the experience to show us that despite the astronomical cost of these projects, nobody is impoverished by them; for it is elementary and classical economics that nobody under our democratic system can be impoverished while the means of production are increased. Poverty and destruction result from the failure to control our waters, not from the investment in opportunity for abundance.

There is a scheme of thought in dealing with water problems, sometimes derisively called the Last Water Hole Theory. Under this, thinking is in terms of the days of the old wild west where you either got water from the last water hole or you didn't get it at all. I would like to suggest that the facts show a new last water hole theory—that we have seen the last of the water holes, and that instead of fighting over what we have, we ought to be devising plans on how to get more.

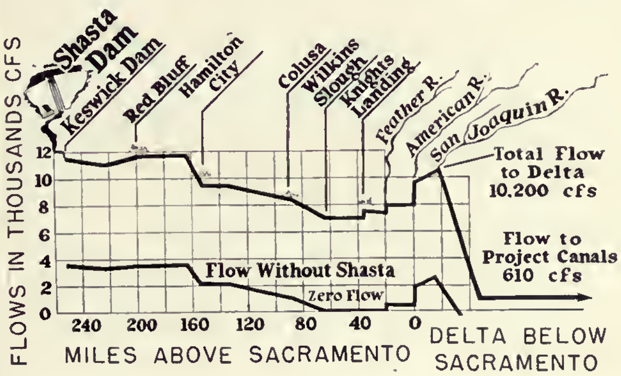
THE END.



"KEEP ON DELIVERING THE WATER" . . . last July Shasta Dam in California, shown at left, held back and controlled the Sacramento River with the results shown below. Note that without Shasta there would have been no water from 30 to 70 miles above Sacramento and none on the Delta below, whereas with Shasta's control 10,200 cubic feet per second flowed to the Delta and 610 cubic feet per second to project canals.

SACRAMENTO RIVER FLOWS WITH and WITHOUT SHASTA REGULATION

JULY 1951



Windbreak Plans for Irrigated Areas

(Continued from page 55)

CARE OF TREES AFTER PLANTING

1. IRRIGATE sufficiently to keep growth satisfactory. Thorough soaking at less frequent intervals is better than frequent light watering.

2. CULTIVATION. Practive shallow cultivation frequently enough to keep the area free of weeds until planting is well established. Do not cultivate after the last of August, so that some vegetative cover will grow for winter protection. After a windbreak has reached a size that makes cultivation difficult, seed the planting to a tolerant grass, such as orchard grass.

3. PRUNING. DECIDUOUS TREES—Prune to a single stem. Remove one side of narrow "V" crotch which will split or break in the wind.

EVERGREEN TREES—No pruning necessary unless double leaders develop. In this case, remove the weakest leader.

SHRUBS—Caragana should be cut back to the ground at the beginning of the second growing season to force branching. Other shrubs need no pruning.

4. PROTECTION. Fence the area to exclude livestock and chickens. Chickens are especially damaging to the buds and roots of your evergreens. Observe frequently for symptoms of insect or disease infestation. Consult your County Extension Agent if any unusual conditions are noted.

If this reprint from the Farmer's Handbook is useful to you and you wish to see more of the same, send a letter to the Editor, RECLAMATION ERA, Bureau of Reclamation, Washington 25, D. C., and we shall be glad to extend the usefulness of this data through printing additional extracts from the Handbook in future issues of the ERA.

More Columbia Basin Farms For Sale

Forty-two full-time farm units in the East-Columbia Basin irrigation district, Adams County, Wash., ranging in size from 51.8 to 115.3 irrigable acres and priced from $707.70 to $2,266 are ready for sale by the United States Government, according to Public Announcement No. 9—Columbia Basin project, Wash.

The farm units are within two to ten miles south and west of the town of Othello (population 500). The center of the area in which the farms lie is about 135 miles southwest of Spokane, Wash., and about 185 miles southeast of Seattle, Wash. Grand Coulee Dam, the key structure of the project is 100 miles to the north, and the farm units are scheduled to receive water in 1953 through a lateral system stemming from the Potholes East Canal.

Farm Application Blanks (Form No. 7–511) and additional information may be obtained from the Bureau of Reclamation, Ephrata, Wash. The deadline for receiving applications is April 1952.

Applications were received between January 1 and the deadline of February 29, 1952, for nine farm units, ranging in size from 42 to 82 irrigable acres, and priced from $924 to $2,650, in the Quincy-Columbia Basin irrigation district near the northern boundary of the project. The public drawing for these units, made available under Public Announcement No. 8, is scheduled around the middle of this month. •

Work Started on Kendrick's Alcova Plant

During the first week in December 1951, the A. S. Horner Construction Co. of Denver, Colo. was awarded the $2,324,224.35 contract for 2 major construction features of the Alcova power plant and appurtenant works on the Kendrick project near Caspar, Wyo. Work was begun in January and is to be completed in time for power to go on the line by July 1954.

Two eastern manufacturers are now working on the hydroelectric generating equipment under separate contracts awarded last June. The Elliot Co., Jeanette, Pa., is manufacturing and will install two 18,000 kilowatt electric generators, under their $887,916 contract, and the Newport News Shipbuilding and Dry Dock Co., of Newport News, Va., was awarded the $496,800 contract for two vertical-shaft 26,500-horsepower turbines for the generators.

A unique heating system for the power plant at Alcova will make it possible to save an estimated $5,000 a year. Natural hot water from a nearby spring, which flows at the rate of 400 gallons of water per minute at temperatures ranging from 100° to 115°, will thus cut down on the heating bill, and also conserve power which would otherwise be used for this purpose. •

The CARLSBAD DOLLAR GOES TO TOWN

by WILLIS C. BOEGLI, Agricultural Economist, Region 5 headquarters, Amarillo, Tex.

BUILDING BUSINESS, CREATING A COMMUNITY of prosperous people in the middle of the desert, and adding to the economic wealth of the Nation. *Photo of the Eddy County Court House (above) in Carlsbad, N. Mex., by C. W. Kopus of Region 5.*

A DOLLAR DOESN'T GO VERY FAR these days, but a dollar's worth of farm crops goes a long way in its effect on local and national business.

First, the farmer sells his crops, pays his hired labor, and the families go to town to buy food and clothing, and maybe take in a show. In town the "butcher, the baker, and the candle stick maker" buy, sell, and trade, and the farmer's dollar—"around it goes, and where it stops nobody knows."

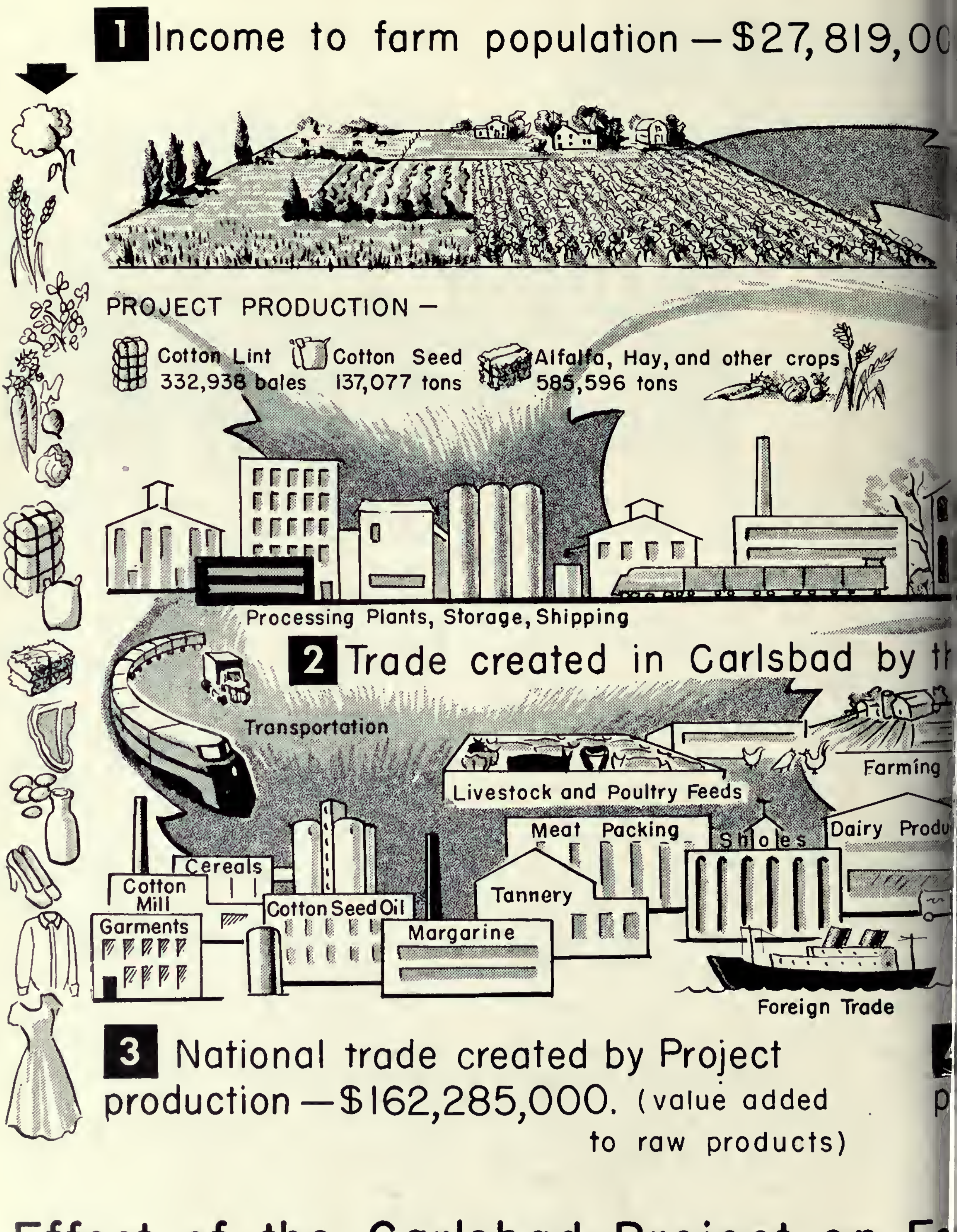
While this is going on, the cotton, hay, grain or other things the farmer sold and the laborer helped to produce, go through the mill, or the gin or the elevator, and head out of town. Some place they are made into cloth, or bread, or sausage, or leather, and some day they will be used by someone, somewhere. A lot of people put a lot of work and a lot of money into making these raw farm products ready for the consumer.

The mine, the forest, and the far away farms produce things that are processed, manufactured, fabricated, canned, and shipped. They come to the town, too, and the farmer, his wife, his family and his hired man buy them. So do the "butcher, the baker, and the candle stick maker" with the money they made from the farmer and his hired man.

These are generalizations. Let's get specific and find out what effect one particular project had on local and national trade in all the business activities it has created in its 44 years of production. Region 5 of the Bureau of Reclamation answers this sixty-four dollar question in its recent report, "An Evaluation of the Effect of the Carlsbad Irrigation Project on the Local and National Economy." This typical southwestern project produced, since it was constructed in 1907, 332,938 bales of cotton, 137,077 tons of cotton seed, and 585,596 tons of alfalfa hay and other crops, with a total value of over 50 million dollars.

The net income of project farmers, the wages earned by farm workers, and the equity developed in farms is estimated at $27,819,000—but this is only the first income created by the project.

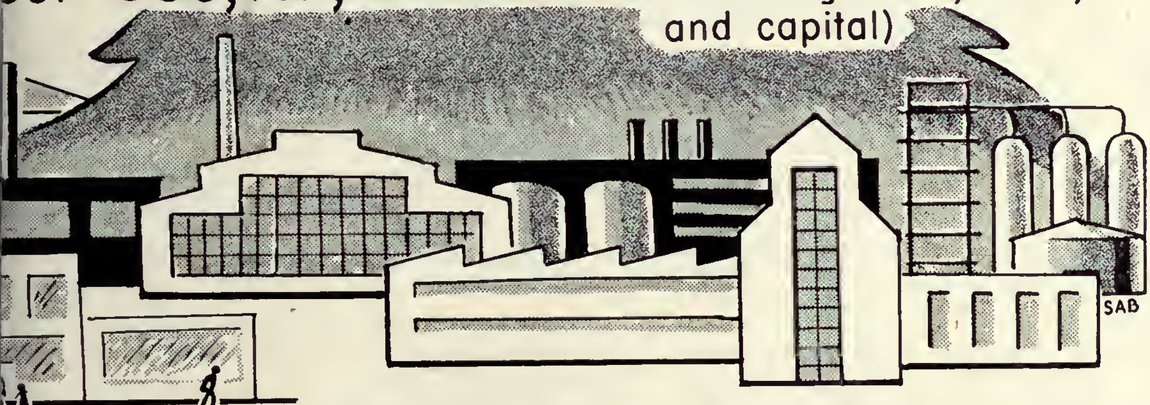
Data from the United States Business Census, adjusted to apply only to the people in the City of Carlsbad that are dependent on the project (62 percent in 1939 and 29 percent in 1948), show that city workers, shop owners and investors had an income of $80,727,000 for their labor, management and capital. During the forty-four years this new trade created by the project on the farms and in the city of Carlsbad is more than double the value of the crops produced. This is about the same relationship as shown by the trade created in Payette, Idaho, by the surrounding irrigated area. (See article entitled, "Irrigation



Effect of the Carlsbad Project on Fo

et farm income, wages to farm workers, equity in farms, and
Government payments to farmers)

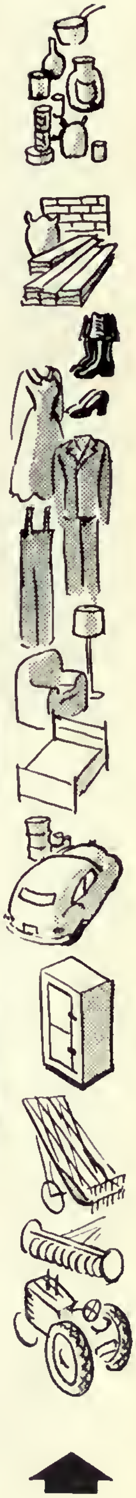
ect – $80,727,000 (income to management, labor, and capital)



etail Sales

Manufacturing, Mining, Processing, Shipping

onal trade to supply Project rural and urban
ion – $35,791,000. (income to management, labor, and capital)



reas of National Economy (1907 – 1950)

Goes to Town" on page 152 of the August 1950 RECLAMATION ERA.—Ed.)

What happened to those 332,938 bales of cotton, the 137,077 tons of cotton seed and all that hay? They took a long trip. Some of the cotton and the goods made from it went abroad, but most of it stayed in the Nation. The spinners, weavers, apparel manufacturers, brokers, wholesalers, shippers, jobbers, all did business with the cotton before it became underwear, shirts, towels, sheets and a thousand and one different things.

The cotton seed went through mills and manufacturing plants, was shipped and hauled, bought and sold, and some place became table margarine, cooking compound, plastic and many other things. The by-products became stock feeds and eventually ended as meats, dairy products, hides, leather, shoes, medicines, fertilizers, and an endless list of things we use every day. The other crops—the hay and the grain—also took a trip, made jobs, and made business for mills, plants, railroads and cities.

If we take the value that is added to all of the crops produced on the project as they pass along the long, long road to the consumer, as the measure of the trade created, we get $162,285,000. Now that's mostly income to labor, capital, and management—additional income actually created by the production of the Carlsbad project.

Now don't forget the purchasing power of the people of Carlsbad. Timber was cut, logs sawed, coal mined, iron smelted, and steel made for farm machinery, furniture, cars, and trucks to go to Carlsbad for that farmer, his farm laborer, and the families in town that live from his trade. Food was canned and frozen, clothes were manufactured, drugs made, and all got to Carlsbad. We have already counted all the trade created by the project in Carlsbad, so we count the income from labor, management and capital that went into all those goods shipped to the city. The value of their trade created to satisfy the purchasing power created by the project is $35,791,000 over the forty-four years.

Altogether, the trade created over the Nation that is measurable is $306,622,000, or about six times the value of the crops produced on the project. This particular business would not have existed without the project.

The project only cost the Government five million dollars, including interest, which is not paid by farmers. Only a little more than $2,000,000 remains to be repaid by the water users under the present contract.

The Carlsbad Irrigation District's Board of Directors and the farm and community leaders deserve a great deal of credit for the successful development of this project and its far-flung benefits.

What effect did the project have on the Nation? Well these are some of the business activities it created. In addition, it changed a desert into an oasis, and made homes for many fine Americans.

THE END.

1951 Good "Reclamation Resort" Year

According to reports recently received, Hoover Dam's Lake Mead, Shasta Lake and Friant Dam's Millerton Lake are becoming major recreation spots in the West.

In addition to marking the year when the four millionth visitor took the guided tour of Hoover Dam, and Lake Mead placed second in popularity among National Parks (see p. 20, January 1952 issue), 350,549 persons visited the Bureau of Reclamation's Exhibit Building in 1951, an all-time record for this popular attraction since it was opened to the public in late 1946. Visitors came from all 48 States.

Nearly a million persons visited the major features of the Central Valley project in 1951. At Shasta Lake many of the 159,000 visitors were attracted by the black bass fishing and other water sports. Camping and picknicking were popular along the lake shore. An estimated 650 locally owned power boats were in use on the lake which has a 265-mile scenic shoreline.

Private organizations, such as California Kamloops, Inc., made excellent progress in the project of stocking Shasta Lake with the famous Kamloops trout of British Columbia (see article entitled, "The Coming of the Kamloops" on page 112, June 1951 issue).

Steelhead trout fishing in the Sacramento River has materially improved over pre-Shasta Dam days. Millerton Lake, behind Friant Dam, has good year-around blue gill fishing, with a total counted annual catch of 100,000 fish. The report showed that 2,225 private boats were licensed for use on Millerton Lake during 1951, in addition to 4,670 rentals. Privately owned concessions operate docks and boat rental services on the shores of both Shasta and Millerton reservoirs. ●

WHAT KIND OF SOIL?—The soil auger can be used to obtain samples for determining soil texture as well as finding out the moisture holding capacity of the soil, and when to apply irrigation water. *Photos by Phil Merritt, Region 1 photographer.*

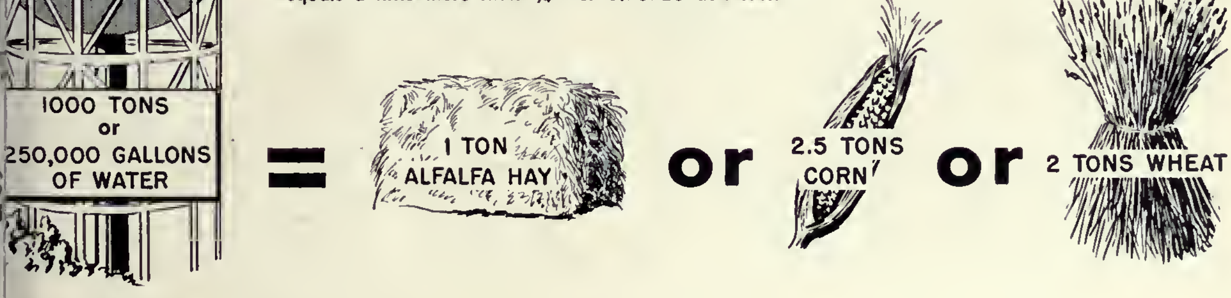
SOIL, WATER, AND AIR

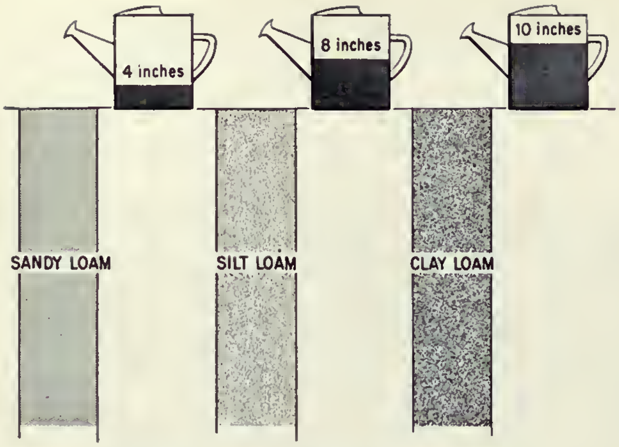
E. N. POULSON, Soil Scientist, and
R. SWARNER, Irrigation Engineer
gion 1 headquarters, Boise, Idaho

rt three in a series of articles on
ls and land classification)

AMONG THE IMPORTANT physical properties of ls are those which enable them to absorb water dily from precipitation or irrigation and to d and transmit it for the use of crops. Water ich enters the soil may be held with varying degrees of availability in three forms, namely: (1) That held tightly in the lower range of balance with the water vapor of the air (humidity) which is not available to plants, (2) that held less tightly in liquid films or masses around the soil particles which form the soil solution and is available to plants, and (3) that which moves freely downward through the root zone unless retarded or obstructed by barriers or layers of low permeability. The latter free-moving water normally percolates downward rapidly and except for

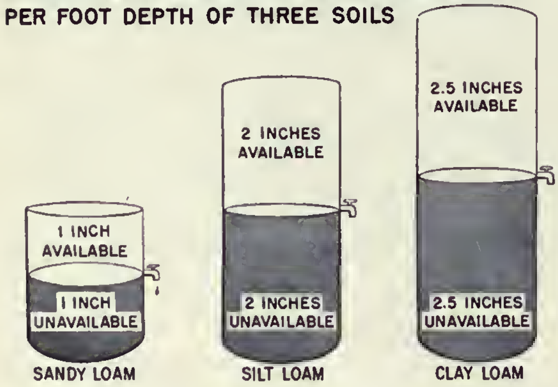
HOW MUCH WATER FOR A CROP? Here is the approximate amount of H_2O consumed by certain crops in arid regions in relation to the harvested product. 1,000 tons equals a little more than ¾—or 0.76726 acre-feet.





THREE SOILS and the approximate inches of water required to replenish the available moisture to a depth of 4 feet, at top o chart. Bottom portion gives an idea of how much water these three soils can make available to plants for each foot of depth. *Drawing at right and at bottom of page 63 by Graphics Section, Washington, D. C.*

APPROXIMATE MOISTURE-HOLDING CAPACITIES PER FOOT DEPTH OF THREE SOILS



a short period is not available to plants. Therefore, the water that is retained in the soil is available to plants until evaporation and plant transpiration reduce it to a point where it is tightly held by the soil. Since plants cannot obtain it, they are permanently wilted. Some crops wilt more readily than others, but the controlling factor in determining the amount of moisture available to crops before they wilt varies with the water-retaining properties of different soils.

The water holding capacity of a soil depends largely upon the total surface area of the soil grains and the percentage of voids between them. The amount of pore space varies with the size and arrangement of the soil particles and ranges from about one-third by volume of the soil mass in sands to about two-thirds in clays. In addition to water, this pore space holds air which is necessary for root development and for the soil micro-organisms. The air volume varies with the soil moisture content. It is greatest in sandy soils and least in clay soils, in contrast to the water volume, which is greatest in the latter. These volumes are, of course, significantly modified by the organic matter and the way in which the soil particles are grouped. In general, a sandy loam retains about one inch of usable water per foot of soil depth, silt loams about two inches, and clay loams about 2½ and sometimes as much as inches or more.

The soil must hold a tremendous amount of water to support plant life and produce satisfactory crop yields. One inch of rainfall or irrigation water spread over an acre provides the soil with 113 tons of water. Of this, 300 to 500 pounds or more of water are necessary to produce only one pound of dry plant material depending on the climate. Alfalfa in humid sections requires about 500 pounds of water for every pound of dry hay produced. That means that a five-ton annual yield of hay will require five million pounds of water and possibly twice as much water per acre. It may be twice this amount in the

HOW MUCH WATER WILL YOUR SOIL HOLD???

If you want to find out how much water your soil holds, use a soil auger to get samples of the soil from the root zone. Gently rub some of the soil sample between your thumb and forefinger to determine the texture. If the "feel" is harsh and gritty, your soil is of a sandy character. If it is smooth and "silky," it is a silty soil. If it rolls up or "balls" between your thumb and fingers, it is clayey. Here is a list of different classes of soil and the amount of water each can hold to feed the root zone of your plants:

Soil class:	*Available water capacity per foot of depth (inches)*
Sands	¼ to
Loamy Sands	¾ to 1
Sandy Loams	1 to
Fine Sandy Loams	1½ to
Clay Loams	1½ to
Clays	2 to

Since you seldom, if ever, wait to irrigate until all of the available moisture is gone from the rooting zone, you do not have to replace the entire moisture-holding capacity of the soil.

re arid regions. This amount of water is ually required by the plant and does not include water lost through evaporation or otherwise. course, the soil cannot absorb and hold this isture in the root zone at one time, and, there-e, it is important that rainfall should occur l distributed during the growing season and t under irrigation the water be applied at a e and in quantities that will produce the most sfactory yields without excessive loss from -off and deep percolation.

(NEXT MONTH—PREPARING FOR IRRIGATION, the story of how the Columbia Basin lands were surveyed and classified.)

vada Reclamation Association Organized

evada's first State Reclamation Association organized in Carson City September 28, 1, superseding the Nevada Water Conference, ich closed its sixth session on that date. The ted officials are Phil Hoover of Ely, president; l Gelmstedt of Yerrington, secretary-treas-r, and Alfred Merritt Smith, State director to National Reclamation Association. •

Walter H. Price Succeeds Robert F. Blanks

Chief Engineer L. N. McClellan announced the ointment of Walter H. Price on November 7 succeed Robert F. Blanks as head of the Bu-u's Engineering Laboratories in Denver, Colo. Price has been with the Bureau since 1930 and been a staff member of the Bureau's laborato-since 1934. In this latter capacity he acquired vide experience in hydraulic and structural dies and experiments, structural design and re-rch, and materials testing and research. At the e of his appointment he was head of the Mate-ls Laboratories.

Price is a member of the Board of Directors in American Concrete Institute, holds committee irmanships and memberships in the AIC, as ll as the American Society of Civil Engineers, l is a member of the Colorado Society of Engi-rs and Sigma Xi. He has authored many re-ts and papers on concrete technology. He re-ved his degree in civil engineering from Tulane iversity in 1930.

Mr. Blanks resigned from the Bureau to accept position of Vice President with Great Western gregates, Inc. of Denver, Colo. •

Progress at Palisades

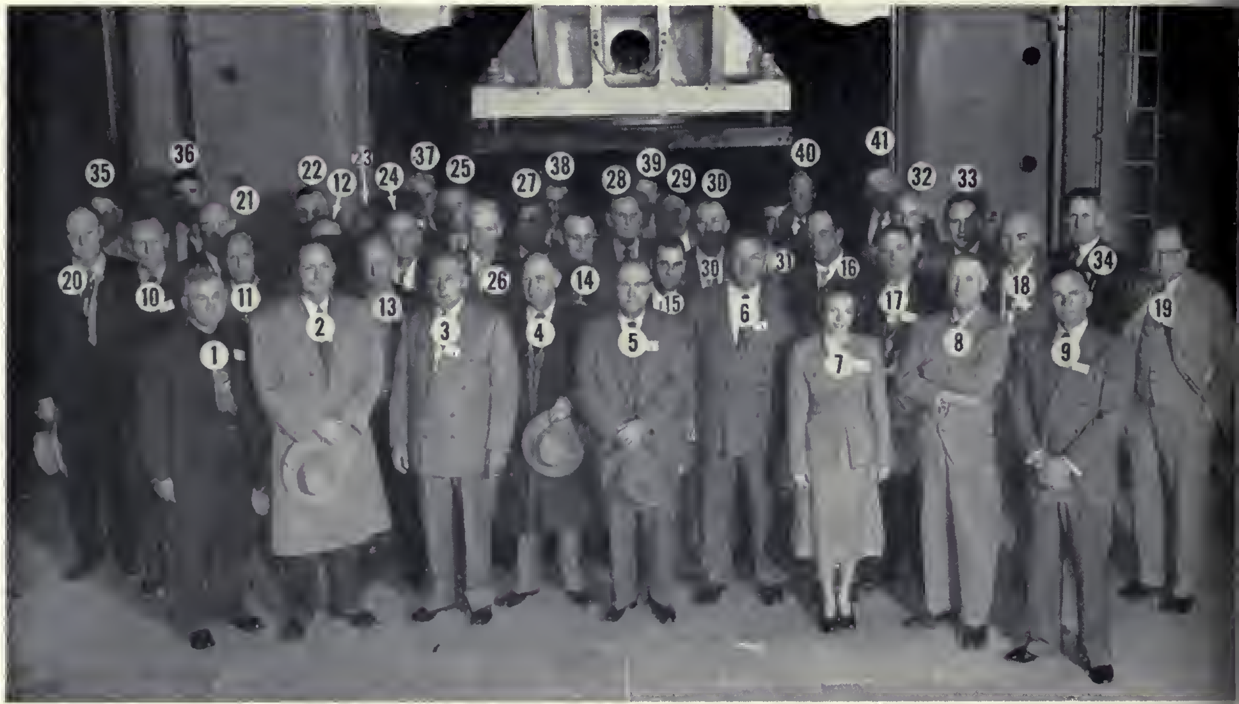
J. A. Terteling and Sons, Inc., of Boise, Idaho, successful bidders on the first major Palisades Dam and power plant contract, began work on the tunnel and construction substation in December 1951, less than a month after Congress authorized $2,000,000 for construction of this plant as a Defense Electric Power Administration-approved project. The construction substation was to be completed in February and the entire contract, which includes open-cut and tunnel excavations for the power and outlet tunnels, must be finished by August this year.

The $76,600,000 multiple-purpose Palisades project will feature the largest earth-fill dam yet built by the Bureau of Reclamation. It will provide 114,000 kilowatts, capable of producing 700 million kilowatt-hours of energy annually, for developing phosphate and atomic energy for defense needs, and will provide downstream benefits for an estimated 650,000 acres of land and flood protection for other lands. In order to provide power for the emergency, irrigators have agreed to a five-year plan giving priority to the use of Palisades water for power production.

Louis B. Ackerman, long-time career engineer in the Bureau of Reclamation, has been appointed construction engineer for the project; I. Donald Jerman is his assistant, and Henry Patrick "Pat" O'Donnell, the experienced earth-dam engineer from Coulee Dam, Wash., is field engineer, supervising all field engineering for the construction of the dam and tunnels. •

MEMBERS OF THE WELLTON-MOHAWK IRRIGATION AND DRAINAGE DISTRICT—Photographed last December as they worked out the terms of their repayment contract. (See "Water for the Wellton-Mohawk" in the January and February 1952 issues.) Seated, from left to right, Frank Batley, L. A. Hicks, President R. H. McElhaney, C. G. Buckeye, and H. J. Woodhouse. Standing, from left to right, J. M. Reilly, Marion F. Griffin, George A. Leach and Wayne T. Wright. *Photo by Samuel B. Watkins, Region 3 photographer.*

The Four States Irrigation Council



REPRESENTATIVES OF WATER USERS on Bureau of Reclamation projects in Nebraska, Kansas, Colorado, and Wyoming voted to talk things over every year with Region 7 officials. They are photographed during their tour of the Engineering Laboratories at the Denver, Colo., Federal Center.

FIRST ROW: (1) Clyde Paine, Frenchman Cambridge; (2) B. W. Moore, Farmers; (3) M. O. Andrews, Pathfinder; (4) E. O. Daggett, Farmers; (5) Ben Harrington, Nebraska-Bostwick; (6) H. E. Thomas, Nebraska-Bostwick; (7) Ruth Sadler, USBR, Reclamation Era; (8) Galen Lowery, Gering-Ft. Laramie; (9) Harold Hobson, Lingle. SECOND ROW: (10) Andrew Young, Mirage Flats; (11) Floyd Brown, USBR; (12) F. M. Jordan, Colorado Ext. Service; (13) Charles Klingman, Gering-Ft. Laramie; (14) Floyd Freeborn, Kirwin; (15) Perry L. Sweat, Kirwin; (16) Jerry Hays, Farmers; (17) Dr. J. B. Fuller, Goshen; (18) Floyd Roush, USBR; (19) Nels Nelson, USBR, Casp THIRD ROW: (20) Walter Skeen, Mirage Flats; (21) Carl Rohwer, S Conservation Service; (22) unidentified; (23) A. B. Robinson, Colorado A & (24) Don Thompson, Frenchman-Cambridge; (25) A. J. Hammond, Co rado Ext. Service; (26) T. Guy Stewart, Colo. Ext. Service; (27) S. Bowman, Pathfinder; (28) Gordon Storm, Pathfinder; (29) Nat Tolm USBR; (30) Lee Vohland, Farmers; (31) T. P. Winchell, Gering-Ft. Laram (32) Paul Hobson, Lingle; (33) Paul Miller, Nebraska Extension Servi (34) James Doyle, Windsor Reservoir and Canal Co. FOURTH ROW: (Walter Barnes, Mirage Flats; (36) Al Richardson, Mirage Flats; (37) Kusko, C. B. & Q. RR; (38) Arnold Lepik, Central Nebr. Public Pow Irrig. Dist.; (39) Earl Phipps, Northern Colo. Water Conservancy Di (40) J. M. Dille, Northern Colo. Water Conservancy Dist., and (41) Ho Ledingham, Gering-Ft. Laramie. Photo by Norton T. Novitt, Regio photographer.

SERVICE AND SAVINGS were the main themes of a helpful, 2-day conference held in the Bureau of Reclamation's Region 7 headquarters at Denver, Colo., on January 16 and 17, 1952.

This was a meeting "of the water users, by the water users and for the water users" called by Avery A. Batson, Regional Director, to give the representatives of water users on reclamation projects in the southern Missouri River Basin opportunity to discuss mutual problems with t Bureau officials.

At the opening session, the conferees appoin Mr. E. O. Daggett of the Farmers Irrigation D trict in Scottsbluff, Nebr., as chairman, and no inated a representative from each of the Sta concerned as members of an operating committ from Nebraska, R. O. Canaday of the Cent Nebraska Power & Irrigation District in G ing, chairman; from Kansas, Perry L. Swe Kirwin Irrigation District; from Colorado, Ja Doyle, Windsor Reservoir & Canal Compa and from Wyoming, Dr. J. B. Fuller, Goshen I rigation District.

At the conclusion of the conference, Chairm R. O. Canaday submitted the following report

MR. PRESIDENT AND GENTLEMEN:

Full names and addresses of the water users' associations mentioned in connection with the above photo (in alphabetical order) are as follows: Central Nebraska Public Power and Irrigation District, Hastings, Nebr.; Farmers Irrigation District, Scottsbluff, Nebr.; Frenchman-Cambridge Irrigation District, McCook, Nebr.; Gering-Ft. Laramie Irrigation District, Gering, Nebr.; Goshen Irrigation District, Torrington, Wyo.; Kirwin Irrigation District, Kirwin, Kans.; Lingle Water Users Association, Lingle, Wyo.; Mirage Flats Irrigation District, Hays Springs, Nebr.; Nebraska-Bostwick Irrigation District, Superior, Nebr.; Northern Colorado Water Conservancy District, Greeley, Colo.; Pathfinder Irrigation District, Mitchell, Nebr., and Windsor Reservoir and Canal Co., Windsor, Colo.

our committee has given consideration to the isability of making this organization perma- and continuing these meetings hereafter.

e believe that substantial benefits will be de- d by having representatives of the operating onnel of the various projects get together and uss numerous problems arising in the opera- of our projects, telling us of the manner in ch they have solved their problems and obtain- the advice and help of others who have similar blems.

e believe that such an exchange of experiences save headaches for the new projects and thou- ls of dollars for each of the projects.

our committee therefore offers the following lutions:

. Be It Resolved that this organization ex- ss to the Reclamation Bureau and to Mr. Bat- and his assistants its appreciation for calling meeting and preparing a very interesting and pful program.

. Be It Resolved that this organization be le permanent, that its officers consist of a presi- t and a committee consisting of five members, member to be chosen by the representative of 1 of the four States represented and one from Bureau of Reclamation.

. Be It Further Resolved that the name of organization be "Four States Irrigation uncil."

. Be It Further Resolved that this organiza- confine its programs and its endeavors to con- uction, operation and maintenance problems.

. Be It Further Resolved that it hold one eting annually at such time and place as shall determined by the committee.

. Be It Further Resolved that the committee the President have the powers and it shall be ir duty to handle all of the business affairs of organization.

. Be It Further Resolved that the President the Committee be instructed to prepare and mit to this organization at its next annual eting a set of by-laws to govern its future ac- ities.

Respectfully submitted,

R. O. Canaday, *Chairman.*

Following the unanimous approval of the re- rt and its resolutions, the water users voted that temporary President and the four committee mbers serve as their elected officers for the com- year, and that Regional Director Avery A. Batson be requested to serve on the committee or designate a representative of the Bureau of Reclamation, to work with the Four States Irrigation Council.

This meeting was run by the water users with the entire facilities of the Regional office and the Engineering Laboratory placed at the disposal of the conferees in order to help them in their business of operating and maintaining Federal reclamation projects. The emphasis of the meeting was on reducing irrigation and maintenance costs, the conferees discussing such items as controlling upland run-off, installing lower cost canal linings, use of new equipment and methods for irrigation districts, maintaining canals, laterals and drains, and new developments in weed control. Several of the discussions will be published in future issues of the Reclamation Era, due to the water users' interest in obtaining and circulating material on these topics. The End.

Harry Strunk Receives Conservation Award

Harry D. Strunk, president of the Republican Valley Conservation Association, and owner and publisher of the McCook Daily Gazette, was presented with the first Interior Conservation Service Award to be given to any man in the Western States on August 31, 1951, by Goodrich W. Lineweaver, Assistant Commissioner of the Bureau of Reclamation, as the personal representative of Secretary Chapman at the annual meeting of the Republican Valley Conservation Association in McCook, Nebr.

The award was made in recognition of his lifetime of work in behalf of the conservation and utilization of the natural resources of the Republican River Basin and the entire Missouri River Basin. Additional information regarding Mr. Strunk's career may be found in the September 1949 issue of the Reclamation Era, which carries his nomination to Reclamation's Hall of Fame.

Reclamation Loses Nelson to Point Four Program

WESLEY R. NELSON, at right, now member of the Technical Cooperation Administration. HARVEY F. McPHAIL, at left, former Director of thhe Division of Power Utilization, who succeeds Mr. Nelson as Assistant Commissioner of Reclamation.

Assistant Commissioner of Reclamation Wesley R. Nelson left the Bureau after 24 years of service on February 1, 1952, to accept an overseas assignment with the Technical Cooperation Administration of the Department of State. O January 31, during a ceremony in Washingto D. C., Secretary of the Interior Oscar L. Cha man presented Mr. Nelson with the Department' highest award, the Distinguished Service Med before a gathering of hundreds of Mr. Nelson friends. He also received a bound volume letters, telegrams, and messages containing ov a thousand names of persons who expressed the regret at his leaving the Bureau and their b wishes and congratulations on his foreign assig ment.

Mr. Harvey F. McPhail, Director of Pow Utilization, a career employee with more than years' service in the Bureau, was appointed s cessor to Mr. Nelson, on February 1, 1952. At t same time Henry B. Taliaferro (pronounced T iv-er) was designated Acting Director of t Division of Power Utilization.

"We are sorry to lose Mr. Nelson," said Co missioner of Reclamation Michael W. Stra "and we are fortunate to have available a man Mr. McPhail's capabilities to succeed him." •

Summer School at Colorado A & M

Colorado A & M College will feature "Hydraulics of Sediment Bearing Channels and Rivers" and "Ground Water Hydraulics" in the annual graduate summer program in hydraulic and irrigation engineering during the first term of the 1952 Summer Session, June 16 to July 11.

"Hydraulics of Sediment Bearing Channels" will be taught by Prof. T. Blench, Associate Professor of Civil Engineering at the University of Alberta. Professor Blench was formerly Director of Research for the Punjab irrigation district and is widely recognized as an authority on the hydraulics of channels in erodible materials. He is author of "Hydraulics of Sediment Bearing Channels" (Evans Industries Ltd. Vancouver, 1951) and numerous technical papers.

C. E. Jacob, Head of the Department of Geophysics, University of Utah will teach the course in "Ground Water Hydraulics." Professor Jacob was formerly Chief of the Section of Ground Water Hydraulics for the U. S. Geological Survey and is author of numerous articles on ground water flow including "Drawdown Test to Determine the Effective Radius of Artesian Well" which won the Rudolf Hering Medal in 1948.

Other graduate courses will be taught by reg lar staff members both during the first term a during the second term July 14 to August 8.

A limited number of fellowships are availa for students interested in regular graduate wor Further information may be obtained by writi to the Dean of Engineering, Colorado A & M College, Fort Collins, Col. •

Region 6 Water Users Hold Fourth Annua O & M Meeting

Discussion of two major themes, better proj operation and maintenance and better use of la and water, marked the fourth annual Region water users operation and maintenance meeti held in Billings, Mont., January 8 and 9, 19

Water users from all major Bureau of Reclam tion projects in Region 6 attended the two-d meeting. These projects include the Shosho and Riverton in Wyoming; Milk River, S River, Lower Yellowstone, and Huntley in Mo tana; Belle Fourche, Angostura, and Rap Valley, South Dakota and Buford-Trenton, Nor Dakota.

At the noonday luncheon on the first day the conference, A. G. Martin, vice president

Cachuma Passes Half-Way Mark

ı mid-January 1952, construction work on the 193,000 Cachuma water project for the City Santa Barbara and adjacent communities in ifornia had passed the half-way mark, and zens of Santa Barbara and nearby Montecito e enjoying a 5,000,000-gallon-a-day emergency er supply from a Santa Ynez mountain strata rcepted during the boring of the main Ca- na project tunnel. The construction schedule s for completing the Cachuma project, begun 950, in the Spring of 1954.

y the beginning of this year the 7.6-mile high- around the Cachuma Reservoir had been com- ed, the Goleta section of the South Coast duit was 85 percent complete, the Tecolote nel, and Lauro regulating reservoir had hed or passed the half-way mark, and work well under way on the Glen Anne regulating rvoir, and Carpinteria section of the South st Conduit. Bids are now being requested for the Otega and Carpinteria regulating reservoirs. Funds for the lateral distribution systems, which are to distribute water from the conduit to the crop lands in the water districts, have not as yet been appropriated. ●

ONE OF THE FOUR regulating reservoirs for the Cachuma project in California is the Lauro Dam, now past the half-way mark. Perspective drawing by M. H. Willon, Denver, Colo.

Billings Commercial Club, spoke of industry's rest in not only the Reclamation development ew land but in maintaining the continued high ductivity of land now under irrigation, due he fact that so much of Montana's continued gress is dependent on irrigation. Speaking at ncheon meeting the following day, H. L. Buck, ings Commercial Club secretary, who also es as Montana State director and national surer of the National Reclamation Associa- , reviewed the NRA resolutions of particular rest to water users that were passed at the l meeting in Amarillo. Buck particularly ssed the importance of the National Reclama- Association's resolution pertaining to soil and er research. Ivan D. Wood, irirgation spe- ist, Soil Conservation Service, Denver, Colo., featured speaker at the conference banquet, ed on proper land development for better er application.

lans for the meeting were developed by E. F. derholm, Region 6 operation and maintenance ervisor, working in cooperation with project er users. At the opening session, Hollis San- d, assistant director, Division of Operation Maintenance, Washington, D. C., and K. F. non, Region 6 Director, emphasized the underlying purpose of the two-day meeting—the exchange of views and information that would result in more efficient operation and maintenance with resultant lower costs to water users. Both speakers also stressed the need for proper care of land under irrigation so that high productivity can be maintained. Equal emphasis was placed on the necessity for restoring the productivity of project lands which had been lost in the past through a lack of knowledge of the best use of land and water. ●

Time to Renew?

You'll find the expiration date of your subscription on the address stamped on the back of your copy of the RECLAMATION ERA. If the number at the left-hand side of the address, directly beneath the number and street reads "6–52," for example, the last issue under your subscription will be the 6th month—June—of the year 1952.

Make sure that you will receive all copies of the RECLAMATION ERA by mailing your renewal at least 2 months before your present subscription expires.

Just send your payment of $1.50 (or $1 if you are a water user or Bureau employee) for 1 year, along with a clipping or copy of your address stamp to Commissioner, Bureau of Reclamation, Washington 25, D. C. Make money orders or checks payable to the Treasurer of the United States. Coins or currency will be accepted—but no stamps, please.

WATER REPORT

By the first of February, with the exception of projects in New Mexico and Texas and the Belle Fourche project in South Dakota, prospects for water supplies for Bureau projects during the coming irrigation season were uniformly good. The Rio Grande project in New Mexico and Texas may be short of water in the early part of the season. If snow accumulation is normal for the remainder of the season on the upper Rio Grande watershed, late season and next year's supply should be more than adequate. Run-off in the Pecos River basin was very low with poor prospects for improvement so water shortages are to be expected on the Carlsbad project. The drought continued in Texas.

In Arizona, storage for the Salt River project had jumped from less than 50 percent average at the end of November to about 160 percent average. In southern California the drought had been broken but run-off to reservoirs was disappointingly low except in the Santa Barbara area.

In three major river basins, the Columbia, Sacramento, and Colorado, flood hazards were beginning to develop. Snow pack on the Columbia River basin was uniformly above average. Grand Coulee Reservoir had been drawn down to offer a measure of flood control. Season precipitation above Shasta and Millerton reservoirs had been almost 150 percent above average and the snow pack was reported as 250 percent normal in some places. Precipitation in the Colorado River Basin continued to be above normal, being 179 percent of the 39 year normal for the period October-January. Lake Mead was being drawn down to provide for storage of a spring run-off considerably in excess of normal.

Although it was still too early for adequate forecasts, it appeared that run-off in the Platte River Basin will be above normal as may be the case in the upper Arkansas.

Here are the water prospects of various regions (see map on back cover for locations) as of February 1, 1952:

Region 1—outlook for water for all projects was good ranging from above normal for the Yakima project to above normal and excessive elsewhere. Run-off in the Snake River Basin will probably be much above normal. Reservoirs were being operated with the expectation of above normal run-off. Storage in Grand Coulee was about 2,000,000 acre feet less than on the same date last year.

Region 2—run-off into Shasta and Millerton Lakes was about 150 percent normal. Prospects are for much above normal run-off for the remainder of the season. Existing storage in Santa Barbara area had been filled for the first time in several years. Run-off past and prospective for the Orland project was above normal.

Region 3—record breaking run-off was still being expected at Lake Mead. Precipitation on the upper Colorado River basin during January was above average continuing a trend that developed last fall. Lake Mead storage was being reduced by maximum power production to provide storage for excess run-off. However, releases may have to be so high as to seriously interfere with the work on the spillway at Davis Dam and with the maintenance of the temporary weir for the Palo Verde project. Storage on the Salt River project was much above average with more storable run-off in prospect. Storage in reservoirs in the San Diego area of California remained low.

Region 4—run-off from the San Juan River basin was expected to be much above normal. Gunnison River run-off should be high since Uncompahgre project reported that the snowfall on the upper Gunnison River watershed had already reached the season's normal. Inflow to Utah Lake was the highest January run-off yet recorded. All Utah and Nevada projects expected above normal water supplies.

Region 5—combined storage in Elephant Butte and Caballo reservoirs of Rio Grande project held 82,400 acre feet at the end of January. The project reports that spring planting requirements are 175,000 acre feet, part of which can be supplied by pumps. Prospects are that these requirements will not be met unless there is above normal precipitation at low elevations in the basin or unseasonable warmth at high elevations. Heavy snow pack in the upper Rio Grande watershed indicates that the total seasonal run-off will be above average. Water supply for the Carlsbad project was inadequate with little prospect for improvement. Storage at the end of January in Conchas Reservoir of the Tucumcari project had declined steadily since 1946, but w[...] supply seemed adequate for this sea[...] Altus Reservoir storage was adeq[...] for project demands.

Region 6—except for the B[...] Fourche project, the outlook for w[...] was uniformly good over the reg[...] Storage in Belle Fourche Reservoir [...] about the same as it was on Febru[...] 1st last year. Snow pack was goo[...] practically all mountain areas alth[...] precipitation on the plains had not b[...] above normal.

Region 7—storage for the Kend[...] and North Platte projects in the No[...] Platte River basin was above avera[...] The snow pack was above average, [...] it was still too early in the season [...] forecast run-off. However, the pros[...] was for above normal run-off. Ru[...] in the plains area was about nor[...] for February. Ample water was st[...] in Medicine Creek, Enders, Bonny [...] Cedar Bluff to meet all anticipated p[...] ect demands. Water supply prosp[...] for the Colorado-Big Thompson proj[...] were reported as very good.

LETTERS

RADA Not Toxic

Southern Okonagan Lands Pro[...]
Department of Lands and Fo[...]
Oliver, B. C., Canada December 12, 1[...]

Dear Sirs: Reference to your ar[...] in your November 19, 1951, maga[...] "The Reclamation Era" re RA[...] for algae, will you kindly advise if [...] is dangerous to human consump[...] We have the problem in our project [...] also the irrigation water is used [...] domestic water.

May we have the courtesy of [...] reply please.

Yours very truly,

D. S. Hodsdon,
Project Manag[...]

Here is our reply to Mr. H[...] don:

Your letter of December 12 [...] been received requesting info[...] tion as to whether consumptio[...] Rosin Amine D Acetate (RAD[...] would be dangerous to human[...]

Our only information on [...] subject has been obtained from [...] publication, Rosin Amine D [...] its Derivatives, distributed by [...] Hercules Powder Co. of Wilm[...]

, Del., the manufacturer of se products. This publication es, "Toxicity tests were made the Industrial Toxicological oratories, Philadelphia, Pennvania, on Hercules Rosin ine D and Rosin Amine D Aces." In regard to oral toxicity publication states:

Acute oral toxicity tests made the Industrial Toxicological oratories indicate white rats y be fed approximately 70 liliters per kilogram of body ght of a 1 percent solution of rcules Rosin Amine D Acetate listilled water without produc- ill effects. This translated to nan body weight would be ghly 70 ml./kg. x 70 kg. eight of average man); or a il of 4,900 milliliters, which is ghly 5 quarts in one dose."

Ve are forwarding a copy of r letter and our reply to the rcules Powder Co. as its repretatives will be informed of your blem and can furnish any addiial information they may have ilable.

Cattail Spray Safe for Cattle

MIAMI COPPER COMPANY,
Miami, Ariz., November 29, 1951.

: RECLAMATION ERA
ureau of Reclamation,
Department of the Interior,
Washington 25, D. C.

ENTLEMEN: We have read with inst a digest in Plant Engineering of r report on "TCA" which states "The bination of TCA and 2, 4–D has en effective in the control of cats."

Ve are troubled with cattails in our ponds, pH 8.4, and would appree any published information that could supply. Also we would like now whether spraying cattails with mbination of TCA and 2,4–D would e the pond water injurious to cattle.

ery truly yours,

B. R. COIL,
Assistant General Manager.

Here is our reply to Mr. Coil:

Ve have received your letter of vember 29 requesting informan on the use of TCA and 2,4–D the control of cattails.

Ve are enclosing a copy of the nuary 1951 issue of the RECLATION ERA which contains on page 6 the original article of which you have read a digest in Plant Engineering. Our standard procedure for spraying cattails is to prepare a solution of 10 pounds of TCA and one pound of 2,4–D (ester or amine form) to each 100 gallons of water and apply this solution at the rate of from 300 to 400 gallons per acre of cattail plants. It is essential that the plants are thoroughly wetted with the solution. As cattail leaves have a waxy covering, it has been found desirable to add to this solution a small amount of wetting or emulsifying agent or 5 to 10 gallons of diesel oil per 100 gallons of water to aid penetration. Perhaps the best time to spray is when the cattail heads are just beginning to form.

We do not believe that this combination will be injurious to livestock as 2,4–D has been tested numerous times with no ill effects. Tests made with TCA on pastures in Michigan did not injure livestock. One of the chemical companies selling TCA reports in its literature "Experimental studies conducted on laboratory animals have shown that sodium TCA 90 percent is very low in toxicity when swallowed. No appreciable hazards are believed to exist in regard to wildlife or livestock which may feed on sprayed foliage." It is believed that any of the solution getting into the pond would be so greatly diluted that there would be no hazard to animals drinking the water.

If you desire more detailed information on the results of TCA and 2,4–D on cattails and the results of tests in your locality, it is suggested that you contact Mr. H. Fred Arle, agronomist, Bureau of Plant Industry, Room 24 Post Office, Phoenix, Ariz., who has aided our Bureau in testing this chemical combination, or write to our Regional Director at Boulder City, Nev.

RELEASES

Point Four in Action

A new illustrated 38-page publication which describes the part that the various Interior Department Agencies are playing in the President's Point Four Program of technical cooperation with peoples of underdeveloped areas of the world is now available free of charge by writing to the Bureau of Reclamation, United States Department of the Interior, Washington 25, D. C. ●

Heading Off Halogeten

The Bureau of Land Management has issued a new illustrated pamphlet entitled "Halogeten" designed to assist farmers in disposing of this poisonous menace. It illustrates the manner in which this weed spreads and poisons livestock, explaining how it can be controlled through reseeding grass.

Copies of this pamphlet may be obtained free of charge by writing to the Bureau of Land Management, Washington 25, D. C. ●

New Shoshone Project Folder

A new folder on the Shoshone project in Wyoming has recently been released. In addition to a number of "before and after" photos it contains a descriptive résumé and statistics regarding the project. Copies may be had without cost by writing to the Regional Director, Bureau of Reclamation, Billings, Mont. ●

Irrigation Advisers' Guide

A 215-page handbook prepared by the Burau of Reclamation in cooperation with the Land Graut Colleges and Universities, and Agencies of the United States Department of Agriculture, is now available at 60¢ a copy from the Superintendent of Documents, Government Printing Office, Washington, D. C. This publication is designed to insure that new irrigators have competent advice in preparing their fields for efficient use of water, constructing effective water distribution systems, and using irrigation water to the best possible advantage. ●

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NOTES FOR CONTRACTORS

Contracts Awarded During January 1952

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contra[illegible] amoun[illegible]
DS-3506	Eklutna, Alaska	Jan. 3	Two 25,000-horsepower, 600-revolutions per minute vertical-shaft hydraulic turbines for Eklutna power plant.	Newport News Shipbuilding Dry Dock Co., Newport News, Va.	$335,0[illegible]
DC-3536	do	do	Furnishing and installing two 16,667-kilovolt ampere generators for Eklutna power plant.	Pacific Oerlikon Co., Tacoma, Wash.	474,2[illegible]
DS-3562	Colo.-Big Thompson, Colo.	Jan. 16	One 1,700-ampere bus structure and 1 generator-voltage switchgear assembly for Pole Hill power plant, schedules 1 and 2.	Westinghouse Electric Corp., Denver, Colo.	23,[illegible]
	do	Jan. 31	1 generator and motor voltage switchgear assembly and 1 protective equipment cubicle for Flatiron power and pumping plant, schedule 3.	Brown Boveri Corp., New York, N. Y.	132,3[illegible]
DS-3565	Central Valley, Calif.	Jan. 18	Three 66,000-kilovolt ampere transformers for Folsom power plant, schedule 1.	General Electric Co., Denver, Colo.	577,0[illegible]
DC-3579, DC-3580, DC-3581, and DC-3582	Missouri River Basin, S. Dak.	Jan. 10	Construction of 2,500-kilovolt ampere Wall, 2,000-kilovolt ampere Wicksville, 6,000-kilovolt ampere Midland, and 5,500-kilovolt ampere Philip substations.	Frank Brink Electrical Construction & Lange Electric, Corsica, S. Dak.	180,[illegible]
DC-3587	Colo. River Front Work and Levee System, Ariz.-Calif.-Nev.	Jan. 5	Construction of earthwork and structures for reservation levees, Lower Colorado River district.	R. P. Shea Co., Indio, Calif.	690,[illegible]
DC-3589	Hungry Horse, Mont.	do	Furnishing and installing 2 electric elevators for Hungry Horse Dam.	Otis Elevator Co., San Francisco, Calif.	169,[illegible]
DC-3590	Eklutna, Alaska	Jan. 18	Two 20,000-kilovolt ampere transformers for Eklutna power plant switchyard.	Westinghouse Electric Corp., Denver, Colo.	114,[illegible]
DS-3594	Kendrick, Wyo.	Jan. 17	2 actuator-type governors with pumping equipment for regulating speed of 26,500-horsepower turbines for Alcova power plant.	Woodward Governor Co., Rockford, Ill.	55[illegible]
DC-3599	W. C. Austin, Okla.	do	Construction of earthwork, asphaltic membrane lining, and structures for Drains A-1, "162", "E", and "F" extension, Altus 21.7 lateral wasteway, and Altus Canal.	Sheppard and Luce, Vernon, Tex.	82[illegible]
DS-3602	Kendrick, Wyo.	Jan. 25	One 100-ton traveling crane for Alcova power plant	Moffett Engineering Co., Albany, Calif.	82[illegible]
DC-3610	Colo.-Big Thompson, Colo.	Jan. 23	Installation of equipment and appurtenances and construction of structures and transmission line for Beaver Creek substation.	Donovan Construction Co., St. Paul, Minn.	134[illegible]
117C-128	Columbia Basin, Wash.	Jan. 11	Earthwork, concrete structures and timber bridges; Area W-3 and W-5 laterals, West Canal laterals.	Lakeside Bulldozing Co., Bellevue, Wash.	19[illegible]
117C-131	do	Jan. 17	Lining repair, East Low and West canals	Cherf Bros. Construction Co., and Gandkay Contractors, Inc., Ephrata, Wash.	46[illegible]
300C-31	Davis Dam, Ariz.-Nev.	Jan. 30	Warehouse extension O & M Area at Phoenix, schedule 1	Daum-Donaldson Construction Co., Phoenix, Ariz.	67,[illegible]
	do	Jan. 24	Utilities and paving O & M Area at Phoenix, schedule 2	Fisher Contracting Co., Phoenix, Ariz.	101[illegible]
703C-220	Kendrick, Wyo.	Jan. 2	Casper-Alcova telephone line	Lively Electric Co., Borger, Tex.	56,[illegible]
701C-223	Missouri River Basin, Nebr.-Kans.	Jan. 21	Drains and protective works for Superior-Courtland Unit	Claussen-Olsen-Benner, Inc., Holdredge, Nebr.	45,[illegible]
701C-226	do	Jan. 29	Stabilization of canal side slopes and construction of timber bridges and concrete checks for Superior and Courtland Canals.	Winslow Construction Co., Englewood, Colo.	102,[illegible]

Construction and Materials for which Bids Will Be Requested by May 1952

Project	Description of work or material
Cachuma, Calif.	Control station chlorination equipment for Ortega and Carpenteria control stations.
Central Valley, Calif.	Construction of the semi-outdoor type 14,000-kilowatt Nimbus power plant to house two 7,500-kilovolt-amperes generators, and the concrete Nimbus diversion dam, on the American River about 7 miles from Folsom, Calif. The concrete dam is to be 22 feet high and 800 feet long with eighteen 40- by 24-foot radial gates. A 10-foot operating roadway is to be provided on top of dam. The power plant structure is to be 120 feet long and 100 feet wide. Installation of embedded turbine parts and 60-ton gantry crane will be included in the contract.
Do	Two 69-kilovolt disconnecting switches, one 69-kilovolt power circuit breaker, and 3 potential transformers for Nimbus switchyard.
Do	2 vertical-shaft, propeller-type, 9,400-horse-power at 41.5-foot head, hydraulic turbines for Nimbus power plant.
Do	Moving and placing houses on foundations, constructing water and sewerage systems, and drilling well at Newman and San Luis wasteways on Delta-Mendota canal near Newman, Calif.
Do	Moving and placing houses on foundations, constructing water and sewerage systems, and drilling well at Balancing reservoir and Kern River on Friant-Kern Canal near Bakersfield, Calif.
Do	Construction of about 14 miles of 340 to 278-cubic feet per second capacity main lateral and 20 miles of 85 to 15-cubic feet per second sublaterals near Madera, Calif.
Central Valley, Calif.	Three 230-kilovolt (900 kilovolt basic insulation le[illegible] 1,000-ampere, 5,000,000-kilovolt-amperes or an alter[illegible] of 7,500,000-kilovolt-amperes interrupting capa[illegible] rating, outdoor, power circuit breakers; one 69-k[illegible] volt power circuit breaker; and seven 230-kilov[illegible] five 69-kilovolt, and three 115-kilovolt disconnect[illegible] switches for Folsom switchyard.
Do	One 4,160-volt outdoor unit substation switc[illegible] having compartments for the following: one [illegible] kilovolt-amperes 3-wire incoming circuit; one [illegible] kilovolt-amperes 3-wire incoming circuit; and se[illegible] 3-wire outgoing circuits for Folsom switchyard.
Do	One 12,000/15,000-kilovolt-amperes autotransformer [illegible] Folsom switchyard and two 7,000/8,750-kilov[illegible] amperes power transformers for Nibus switchyar[illegible]
Do	Three 3,000-ampere bus structures with curren[illegible] potential transformers, lightning arresters, [illegible] capacitors, disconnecting, and grounding swi[illegible] and one 13.8-kilowatt circuit breaker for Fo[illegible] power plant.
Do	Station-service unit substation for Folsom power p[illegible]
Do	Main control board extension for P. G. & E. lines [illegible] transfer breaker in Tracy switchyard.
Do	Traveling water screens for Exeter Irrigation Distr[illegible] No. 2.
Do	Two 7-cubic feet per second, one 4-cubic feet per secon[illegible] and 2-cubic feet per second, all at 25-foot head, de[illegible] well or propeller-type motor-driven pumping un[illegible] for pumping plant D-3, Delano-Earlimart irrigat[illegible] district.

Construction and Materials for which Bids Will Be Requested by May 1952—Continued

Project	Description of work or material
lo-Big Thompson, Colo.	Installation of trashrack and bulkhead on Rist Creek siphon entrance to Poudre supply canal 9 miles northwest of Fort Collins, Colo.
....	Installation of gaging equipment and control line at Olympus siphon and deicing equipment at Olympus dam near Estes Park, Colo.
....	Addition of 10,000-gallon septic tank complete with effluent line and drying bed at Green Mountain government camp 15 miles south of Kremmling, Colo.
....	Landscaping and construction of concrete gaging station at West Portal of Alva B. Adams tunnel near Estes Park, Colo.
....	Eight draft-tube bulkhead gates with lifting frame and one bulkhead for Flatiron power and pumping plant.
bia Basin, Wash.	Installation of two 65,000-horsepower, 720,000 gallons per minute pumps Nos. P5 and P6 in Grand Coulee pumping plant; miscellaneous metalwork including doors, louvers, handrailing, ladders, grating, covers, and plenum in Grand Coulee dam, pumping plant, and power plants; and electrical installation for Grand Coulee dam, pumping plant, and power plants.
....	Construction of 17 miles of laterals, 36 miles of sublaterals, and 14 miles of drain wasteways, from 511 to 3 cubic feet per second capacities, for lateral area W-6A on West canal, south and east of Quincy and Winchester, Wash. The laterals will be unlined except where buried asphalt membrane is used.
....	Construction of 3 miles of 30 cubic feet per second capacity lined channel, 5 miles of 60 cubic feet per second capacity unlined channel, and 9 culverts and a drop for interception and conveyance of excess ground water in the vicinity of Soap Lake, Wash.
....	Construction of 1¾ miles of unlined wasteway for lateral area E2, 3 checks, 1 small pump structure, and railroad crossing.
....	Construction of permanent vault and temporary storage room in the Ephrata warehouse. The 21- by 13-foot vault will have concrete block walls and reinforced ceiling slab. The 21- by 20-foot temporary storage room will have concrete block walls and wood ceiling.
Wyo	Construction of 0.42 mile of 475 cubic feet per second capacity earth-lined Means canal; enlargement and rehabilitation of 6.5 miles of Eden canal to 300 cubic feet per second capacity, part of which is to be lined; construction of 2 miles of Eden canal laterals, 20 to 5 cubic feet per second capacity; and relocation of 0.35 mile of Dry Sandy Creek channel, 670 cubic feet per second capacity, 44 miles northwest of Rock Springs, Wyo.
a, Alaska	Construction of the two-unit 30,000-kilowatt Eklutna hydro-power plant near Palmer, Alaska. The powerhouse superstructure will have steel framing and concrete curtain walls; either wood piles or concrete caissons will be required for the foundations. The structure will measure 71 by 74 feet in area and 50 feet in height from generator floor to ceiling. The contractor will install two 21,000-horsepower Government-furnished turbines and a 40-ton traveling crane. Switchyard steel structures, to be furnished by the
Eklutna, Alaska—Con.	contractor, will be installed on the roof of the power plant. A machine shop similar in construction to the powerhouse will be built adjacent to the powerhouse.
Do	Main control board, annunciator relay cabinet, station-service transformers, distribution board, battery control and distribution board, and battery chargers for Eklutna power plant.
Do	Two 66-inch butterfly valves with accessories for Eklutna power plant.
Fort Peck, Mont.-N. Dak.	Construction of 115/12.47-kilovolt Dawson substation at Glendive, Mont., involving erecting steel bus structures, installing Government-furnished major electrical equipment, and furnishing and erecting warehouses and service buildings. The Government will furnish the steel for most of the 115-kilovolt structures and the contractor will furnish the remaining 115-kilovolt and 12.47-kilovolt wood structures. Installation of an additional bay in Williston substation is also included.
Kendrick, Wyo	Alcova warehouse to be erected near Alcova Dam, 32 miles southwest of Casper, Wyo., requires the contractor to place concrete foundation and floor and gravel under floor, erect a 50- by 77-foot prefabricated metal warehouse, furnish and install electric unit heaters and lighting system, and construct a wood-timber loading dock. The Government is to furnish the prefabricated building and loading dock timber.
Do	Installing transfer pumps and furnishing and installing pipe for oil-handling equipment at new Casper substation.
Do	Station-service unit substation for Alcova power plant.
Do	Turbine draft-tube gates and accessories for Alcova power plant.
Palisades, Idaho	Construction of Palisades earth-fill dam and 114,000-kilowatt power plant and relocation of 21.5 miles of road on the south fork of the Snake River in Bonneville County, Idaho, 7 miles east of Irwin.
Do	Four vertical-shaft, Francis-type 39,500-horsepower at 190-foot head, hydraulic turbines for Palisades power plant.
Missouri River Basin, Mont.	Three 33.3-cubic feet per second capacity at 180-foot head horizontal, centrifugal-type, motor-driven pumping units for Crow Creek pumping plant.
Missouri River Basin, Nebr.	Construction of 15 miles of Franklin unlined earth canal, having 14-foot bottom width and 230 cubic feet per second capacity, diverting from Harlan County Dam and running along the north side of Republican River Valley to about 3 miles beyond Bloomington, Nebr. Work will include fourteen 78-inch precast-concrete pipe structures; 24 precast-concrete pipe culverts; 9 monolithic box culverts; 27 turnouts; 2 orifice checks, highway and farm bridges, 2 wasteway structures, drain inlets, and check; and road relocations and intercepting drains.
Missouri River Basin, N. Dak.	Construction of 29 pumping and relift pumping plants for the western one-third of the Heart Butte unit, 8 miles north of Flasher, N. Dak. to the Heart Butte Dam.

United States Department of the Interior, Oscar L. Chapman, Secretary

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THE RECLAMATION AREA

the Reclamation ERA

April
1952

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FEATURE ARTICLES

SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1.50 a year for persons residing in the United States and Canada; $2 a year for foreign subscriptions; special rate of $1 a year for members of water users' associations, and Bureau of Reclamation employees. No stamps, please!

OUR FRONT COVER

NEW HORIZONS—NEW FARMS

This scene will be repeated many times in the future as Columbia River water reaches the main laterals on its way to the project lands. After the initial delivery of enough water for 87,000 acres this year, the Bureau plans to add 60,000 acres a year until a million acres are under irrigation. *Photo by H. E. Foss, Region 1 photographer.*

35 YEARS AGO IN THE ERA

In the great work of making our Nation prepar[ed] for any emergency that may arise, the Reclamati[on] Service is doing its part as well as limited fun[ds] will permit. Personally we regard it just as i[m]portant that every acre which will grow cro[ps] should be planted as it is to spend hundreds [of] millions on battleships and munitions. We are n[ot] joining the pacifists either. While millions a[re] being provided for the soldier and sailor, we thi[nk] it would be wise to add another million acres [of] irrigated land to our crop-producing area. W[e] have the land and water, we have the land hung[ry], but we haven't $50,000,000 for the irrigation work[s]. Why not ask Congress to issue bonds and raise i[t]? It will be repaid not only in dollars, but in maki[ng] citizens who will have something better than [a] boarding house to fight for; in $50,000,000 wor[th] of food each year and in the development of a doz[en] commonwealths. In the crisis which threatens o[ur] Nation the farmer is going to play a mighty i[m]portant part. . . . It takes a lot of fellows hamme[r]ing away far from the scenes of strife to keep o[ne] man at the front, and a good many of these will [be] farmers.

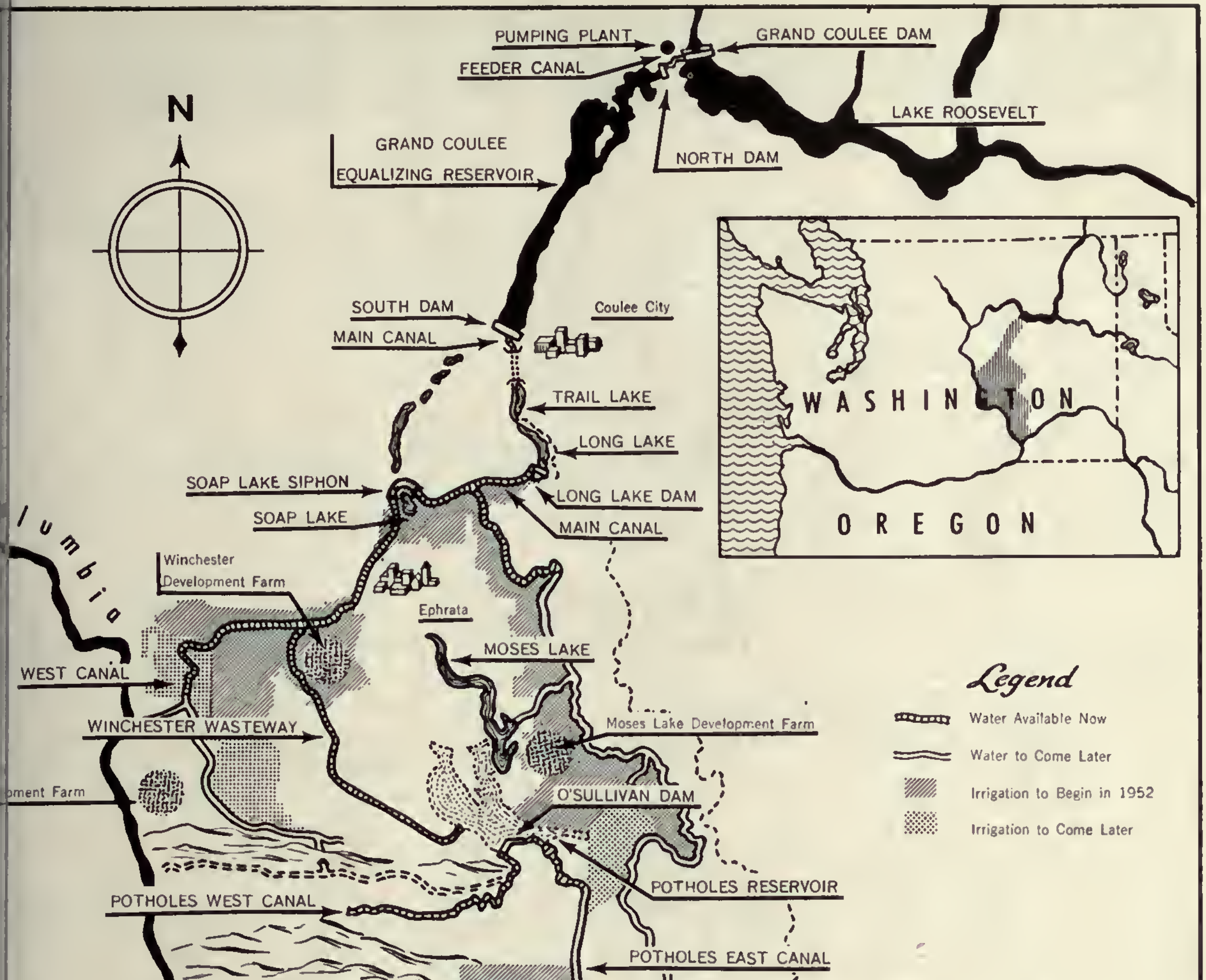
(From column entitled "Current Comments" b[y] C. J. Blanchard, statistician, on p. 162 of th[e] April 1917 issue of the RECLAMATION RECORD, pred[e]cessor to the RECLAMATION ERA.)

THE FIRST OF A MILLION ACRES

Next month the State of Washington will celebrate the co[mple]tion of facilities for irrigating the first 87,000 acres of an ult[imate] 1,000,000-acre project—the Columbia Basin project—under [con]struction for a little more than 18 years.

For 35 years or more people of the Northwest have dre[amed] of the day when a dependable supply of water could be deli[vered] to the huge tract—water that would turn the sagebrush-co[vered] area into a community of fertile farms.

In honor of the celebration, the RECLAMATION ERA has dev[oted] the entire contents of this issue to topics concerning the Colu[mbia] Basin project. Obviously, many interesting items have [been] omitted, and many phases of this gigantic work have not [been] mentioned, but we wish to express our deep appreciation to [those] who have contributed to this special issue, particularly repres[enta]tives of cooperating agencies in the Pacific Northwest wh[o are] working together to make the most of this vast project, des[igned] to benefit the entire Nation.



COLUMBIA BASIN PROJECT

992016—52——1

HOW THE PROJECT BEGAN

by W. GALE MATTHEWS

Resident of the Ephrata, Wash., area since 1890 and President, Grant County Title Abstract Co.

How, WHEN AND WHERE did the Columbia Basin Reclamation project start?

Probably the full story will never be written for there is no one who really knows all of the details which led to the inception of this tremendous project, but on this and the following page are depicted some of the highlights and sidelights of which I have learned and through which I have lived.

1879

FIRST REPORT ON COLUMBIA BASIN—Lt. Thomas W. Symons, U Army Corps of Engineers, in charge of Northwest area, says the Columbia Basin in annual report: "All in all, it is a desolat where even the most hopeful can find nothing in its future cheer."

1897 • 1898

BROOK LAKE PLAN PROPOSED by J. R. McIntyre, of Puget Sound country, who has vision of irrigating approximately a half a township of land between Stratford and Ephrata in the general area south and east of Soap Lake by diversions from Brook Lake (now known as Stratford Lake). McIntyre contracts to buy a large number of 640-acre railroad grant sections from the Northern Pacific Railway Co. He forms the Cooperative Irrigation Co. and assigns his interest to it.

GREAT NORTHERN RAILROAD FINANCES PLAN.—McIntyre co tracts with James J. Hill of Great Northern Railway Co. to finan construction. Ditch started. Company gets into financial di culties. After one or two reorganizations, ditch is constructe large aqueduct built across swamp west of Adrian. Water actua delivered to some land, but the program fails. Reclamation Se ice surveys area in 1904 and 1905, considering possibilities Columbia, Spokane, and the Palouse rivers.

1907

LAKE WENATCHEE PLAN PROPOSED.—Quincy Valley Water Us Association formed. Joseph Jacobs, Seattle consulting engin studies plan of watering Quincy Valley from Lake Wenatc Water users encouraged by his report.

WATER USERS ORGANIZE Quincy Valley Irrigation district under State law, and levy assessments on land to pay for detailed plans and studies. By 1910 Columbia Basin area settled by homesteaders encouraged by lush appearance of bunch grass and sagebrush. Dryland farming unsatisfactory. Crops dwindle year after year due to lack of rainfall.

1910

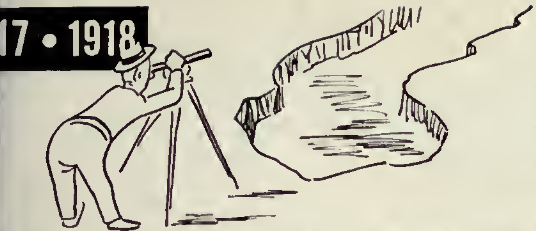
1914

STATE TURNS DOWN WENATCHEE PLAN when asked to raise bond issue of several million dollars to irrigate Quincy flats. State and Reclamation Service cooperate in survey of Palouse River to irrigate Pasco area. War breaks out in Europe. Emphasis on raising food.

1917

GRAND COULEE PLAN PROPOSED.—Famous meeting in Attorney William M. Clapp's office, with A. A. Goldsmith of Soap Lake, Paul D. Donaldson, Superior Court Judge Sam B. Hill, W. Gale Matthews, at Ephrata, Wash.

17 • 1918



SURVEY OF GRAND COULEE.—Ephrata group, intrigued by Donaldson's report of trip with Dr. Landis, of University of Washington, regarding theory of nature having dammed Columbia River with ice, manages to obtain county commissioners' approval for Norval Enger (Grant County deputy engineer) to make "off-the-record" survey of possibilities of damming it with concrete. Enger runs a set of levels from the river up into Grand Coulee. Reports back that the idea might have merit, but requires more study and more money than the county could pay.

JULY 18, 1918

LEE SIGNAL GUN FIRED.—Rufus Woods, publisher of the atchee Daily World, visits Matthews for a story, is taken app for information on a proposed dam in the Columbia at the head of Grand Coulee. As a result the first article written on Grand Coulee Dam appears with its famous ration of 2,000,000 wild horses. Story ridiculed. Woods d "Baron Munchausen."

1918 • 1919

THE FIGHT BEGINS.—Columbia Basin Irrigation League formed in Pasco to support Pend Oreille, or gravity plan, to reclaim Columbia Basin lands by bringing water from Idaho lakes. Hon. J. P. Simpson dedicates his Grant County Journal to Grand Coulee. Grant County Treasurer Frank T. Bell, Reclamation Commissioner A. P. Davis, Engineer Col. Hugh Cooper, and Jim O'Sullivan favor and work for Coulee Dam plan.

923

AT THE NATION'S CAPITOL.—Frank T. Bell becomes private secretary to Washington State's Senator Clarence C. Dill. Bell convinces Dill of merits of Grand Coulee osal. Dill becomes active proponent of dam. Explains need for and complete investigation to senior Senator from Washington, ey L. Jones, chairman of the Senate Appropriations Committee. s succeeds in including $600,000 in Rivers and Harbors part of appropriations for the first session, Sixty-ninth Congress, for investi-ng the Columbia River from the Canadian boundary to the mouth e river, considering the river's maximum development for power, gation, flood control, and reclamation. The appropriation passes.

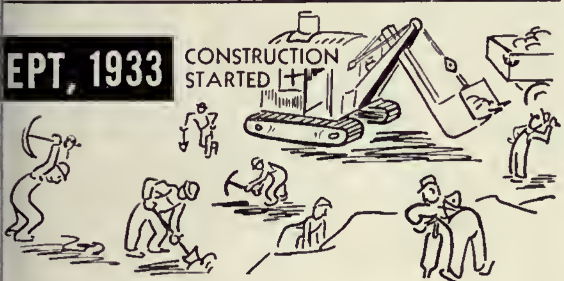
27 • 1930

1931

"308 REPORT" SUBMITTED by Corps of Engineers, United States Army, incorporating former studies by Columbia Basin Commission and Bureau of Reclamation. Settles controversy over source of water for the project, and forms basis for further and more complete investigations leading to the authorization of the Columbia Basin project as a multiple-purpose reclamation development. Stakes driven for dam axis Sept. 1933.

EPT, 1933

CONSTRUCTION STARTED



1952

WATER FROM COULEE FEEDS ARID LANDS OF COLUMBIA BASIN

few names are mentioned in this short pres-ation. It must be understood that the persons ned are not the only ones who took an active t in the promotion of this great project. The nber of those engaged in the work is thousands. became a great community, county, State, and leral project, and through the magnificent rk of the people in the entire Northwest, the project is no longer the dream of a few timid souls in Ephrata, but it is a reality. For generations to come, it will be a monument to united community effort. It will be a memorial to those hardy individuals who braved the uncertainties and hardships of a pioneer existence to homestead this area at the turn of the century and pave the way for a new empire. ###

992016—52——2

GRAND COULEE AND THE DAM.—At left, a view of the site of Grand Coulee Dam from Crown Point in July 1934, just after the awarding of the contract to M. W. A. K. Below, the same view in May 1950, with the Government town of Coulee Dam in the foreground. *Photo at left by K. S. Brown, below by J. D. Roderick, both Bureau of Reclamation photographers.*

by FRANK A. BANKS

Builder of Grand Coulee Dam and former District Manager, Columbia Basin project

How the Dam Was Built

It took but eight years to build the Grand Coulee Dam. In the period between December 1933 and the end of December 1941, the main structure of the dam was placed in the Columbia River Canyon, to become the biggest concrete structure ever built by man.

Construction on the power plant, and more recently in the pumping plant, continues to this day. Even now, the total construction of the Columbia Basin project is only a little more than 60 percent completed.

Grand Coulee Dam naturally presented a number of problems of unique proportion. Others were neither unique nor of great proportion, but they were still problems.

Before construction could get well under way, towns had to be built from the ground up by the contractors and by the Government, 30 miles of railway built, an access road provided, and high-tension transmission lines strung in to satisfy the demands for electric power to run the vast operation.

There were only the old Seaton cable ferry and three farm families in the damsite area when C. M. Cole, Althe Thomas, Harold Shearer and I drove the stakes for the axis of the dam on September 9, 1933. A few months later, the preliminary contract for removal of overburden was let, and work was under way.

By July 1934, the first major contract for the construction of the dam was awarded to a combination of builders known as M. W. A. K., the Mason-Walsh-Atkinson-Kier Co., named after the principal builders in the group.

In a little more than 3 years, this group built the base of the large dam. The base itself was the biggest man-made monolithic structure on earth, far surpassing the great Pyramid of Cheops, for centuries man's biggest structure, until Hoover Dam was built.

In general, the problem of handling the bulky swift-running Columbia River was treated successfully as a juggling operation. The river was channeled to the right, while work was under way at the left; back to the left, so the work could proceed at the right; back and forth until the eventual completed height was reached.

One of the first steps was the building of the west cofferdam, virtually along the left bank of the then-existing channel. Inside the cofferdam

0-acre work area was provided, and the job of aping clean to bedrock proceeded.

\s soon as the granite was cleaned and surface outed for water tightness, the placing of the t of the 10,230,776-cubic yards of concrete be-1. This was celebrated on December 6, 1935, en Gov. Clarence D. Martin officially tripped first 4-cubic yard bucket onto bedrock.

[n the completed dam, 12,000,000 barrels of ce-nt or 48,000 carloads were required. The ight of the water alone that went into the dam s 1,040,000 tons.

\s soon as the base for the west side of the dam s brought up to an elevation above low water, west cofferdam was opened, and the cross-river ferdams were closed, so that similar work could ceed on the east side.

[t was in the course of this excavation that a ,000-yard mass of plastic clay on the east bank an sliding, thwarting all the efforts of our engi-rs to stop the mass, so the pouring of concrete ild proceed.

)ne of our young engineers came up with the a of freezing the toe of this mass of clay, using rigerating equipment, and the now-famous ice m was born. With its help, the east abutment undation was poured between August 1936 and ril 1937.

The base of the dam was completed in the fol-ving winter, and on February 7, 1938, the sec-l contract, for the completion of the dam, was arded to another group of contractors, known the Consolidated Builders, Inc. These in-ded, in addition to the original contractors, the nous Six companies that had built Hoover m, and the General Construction Co. that built yhee.

Parts of three steel trestles, used in construction place concrete, were buried in the dam as the ucture rose toward its ultimate height of 550 t above lowest bedrock.

Records were set, too. In the top day, May 25, 39, a total of 20,684 cubic yards of concrete was ced.

In the peak year of employment, more than 00 men were at work.

The job had started in a depression, and it was aring completion in a period of mounting na-nal tension. When Pearl Harbor came, the in structure of Grand Coulee Dam was virtu-y completed.

The center of attention became the power installations. One 108,000-kilowatt generator was already in service before the end of 1941.

Five more main generators were rushed to completion and two units scheduled for Shasta Dam, not then ready for them, were installed temporarily at Grand Coulee, to boost the power output in the Northwest.

Shipyards on the Pacific Slope turned out a vast flotilla of many sizes and types of ships for the democracies. One Portland shipyard, it is estimated, launched more ships than the entire Nation did in World War I.

Aluminum also became important to aircraft production and other uses, and shortly after the end of World War II, almost half of the Nation's supply of this metal was produced in the Pacific Northwest. Large blocks of Grand Coulee power went to the aluminum plants.

The demand for Grand Coulee power continued so high even after the war, that the installation of generating equipment was accelerated so that the left powerhouse facilities were completed in 1948, far ahead of original schedules. Installations were started in the right powerhouse in 1949. That powerhouse, too, is virtually completed, its last unit being placed into service on September 14, 1951. Only miscellaneous architectural finishes or other final touches remain to be done.

When the word of the Japanese surrender arrived and the first peacetime appropriation was received, we were ready to begin the construction of irrigation facilities. Once again, Grand Coulee buzzed with heavy construction equipment, as the building of the 12-unit pumping plant was started.

Now the pumping plant is in operation; the 12-foot discharge pipes are ready to carry the water which is lifted 280 feet out of the river canyon, to flow onto the first land to produce crops this season.

The installation of pump units will continue, until 10 units, capable of pumping more than 10,000,000,000 gallons of water a day, will be able to irrigate a total of 1,029,000 acres. Eventually two more units may be installed as "spares" or to utilize off-peak power.

The construction of the Columbia Basin project already is in the nineteenth year. It may be close to twoscore years before the final piece of heavy construction equipment leaves and the last Bureau of Reclamation contract on the job is marked completed. ###

Sealing the Ice-Channel

by H. P. "PAT" O'DONNELL

BETWEEN NORTH AND SOUTH DAMS—THE EQUALIZING RESERVOIR.—At left, a view of North Dam and the Feeder Canal. At right, the South Dam. *Photo at left by H. W. Fuller, at right by F. B. Pomeroy, both Region 1 photographers.*

H. P. "Pat" O'Donnell, who was resident engineer for the Bureau of Reclamation on both the North and South Dam jobs, worked on the Columbia Basin project for approximately 11 years. He was recently appointed Field Engineer at the Bureau of Reclamation's Palisades Dam in southern Idaho, and he is now at work on that project.

NATURE TOOK SEVERAL THOUSAND YEARS to carve the Grand Coulee with the steep vertical walls that towered as high as 600 feet above us.

Forty cubic miles of earth and rock had been washed away by the Columbia River in carving the channel after ice blocked the original course, much as the Grand Coulee Dam does today. We put just a small portion of that back.

It took the Bureau of Reclamation and private contractors almost 5 years and approximately $8,000,000 to create the earth-fill dams. At that, we finished a little ahead of schedule. The dams are small but only when compared to the massive works of nature that surround them, and of course to the Grand Coulee Dam, which is the biggest of all concrete dams.

Our dams, unlike Grand Coulee, are earthfill. They are known by the accurate, descriptive, if unromantic, titles of North and South Dams. South Dam is almost 2 miles long and the crest is sufficiently wide to accommodate the main east-west United States and State Highway 2.

The two dams we built are 27 miles apart by air. By boat, it is about a 30-mile trip. Between them, today, is a peaceful reservoir.

Our job, in the main, was to provide a natural, 27-mile channel, which otherwise would require far more expensive construction in a concrete-lined main canal, and to provide a large storage reservoir for the project.

Approximately 1,000,000 acre-feet of active storage capacity for irrigation water is availab[le] in this lake. That's almost enough to raise crop[s] for 1 year on 250,000 acres of land—just abou[t] a fourth of the entire ultimate million-acre C[o]lumbia Basin project development.

Water can be pumped into this reservoir, [i]n the 280-foot lift out of the Columbia River by the world's largest pumps.

Some of this water can even be pumped into the reservoir in the fall for the next irrigation season almost 6 months away.

South Dam was built under a contract for $3,221,253.23 by Roy L. Blair and James Cric[k] & Sons, Spokane contractors. They got their notice to proceed on August 28, 1946.

Only at the end of this work, almost 3 year[s] later, was the contract for North Dam (including a portion of the Nation's largest feeder canal which empties past it) awarded to J. A. Terteling & Sons Co., Boise, Idaho, for $5,216,049.16.

Structure of the dams was nothing unusual a[s] earth-fill dams go. Digging them, however, was. It meant going thousands and even millions of years into the past.

W. E. "Brownie" Walcott, our Bureau of Reclamation geologist, traced the age of the basalt lava flows to the Miocene age which, according to general belief, took place about 16,000,000 years ago.

The glacial deposits are of Pleistocene age, and less than 1,000,000 years old. In excavating the foundation for North Dam, we ran into shales, sands, and basaltic formations of both ages and many in between—partly because the site was a[t] slide area. Time had been the mixer of the s. We had advance information—drill holes k more than 600 feet in places along the axis— to be on the safe side, we deepened our excaon about 30 feet in the center and in the cons with the left abutment.

ig chunks of basalt rock overhanging the ler canal near North Dam also presented a blem. Some of the chunks were more than 50 high—about as big as a five-story building. re was danger that some of them might tumble our canal excavation, so we replaced the open l in one 2,100-foot-long stretch, by buried twin er pipes, each 25 feet in diameter. These two es can almost carry the average flow of the orado River at Hoover Dam—or about 16,000 ic feet of water per second.

he excavation for them was a delicate job. contract originally called for digging no more n 100 feet ahead of the barrel and backfilling nore than 100 feet behind.

lowever, as the contractor cut into the critical ı, the uphill side began to slide. We re-negoed to reduce the distance to 75 feet in the slide ı. In addition, the contractor expedited his k to a 24-hour-a-day schedule, 7 days a week. continued that schedule for three weeks. At end of that time, the job was completed, with- mishap. Measurements have shown that re has been no movement of earth in that area e.

ome of the basalt boulders that had tumbled n from that north wall of the coulee centuries ore stood in the way of North Dam. One of m was big enough and sufficiently solid that we made it the right abument of the dam.

We also had to build an auxiliary dam, in a part known as the Delano Saddle near the left abutment of the North Dam. We found a side channel the Columbia had left. Backfilled, in the course of time, this little fork, which turned out to be about 110-feet deep, had to be sealed up to assure against any major leaks in the north end of the reservoir.

The clay and silt used for fill material was nearby in the case of each dam. Some of it had been left, conveniently for us, by the glacial runoff. The rest was wind-blown material, all within relatively handy hauling distance for the 20- and 24-ton carry-alls that hauled in the earth. The material was closely compacted by sheepsfoot rollers and the continual packing down was accomplished, in general, in layers of 6 inches.

We started building up South Dam in the center with a concrete core wall several feet high. Around this, we compacted the clay and silt, permitting the use of zones of coarser materials as the fill continued outward to the coat of jagged rock riprap to guard against erosion on the surfaces.

In North Dam, the concrete core, or cutoff wall, was only on the two rock abutments. The backfill in the old channel was on original ground with no concrete cutoff wall.

In South Dam alone, there were more than a million and a half cubic yards of fill material. The finished dam was 450 feet wide at the base, 42 feet wide at the top, and it stood 80 feet above the natural ground level. The length is nearly 10,000 feet.

###

TH DAM'S CONCRETE CORE (below) with "Pot" O'Donnell supervising mon to the who is cleaning up the bedrock. At center, below, the old highwoy through the d Coulee os the woter grodually rose in the ice-oge channel of the Columbio r. A new highwoy skirts the eost wall of the Coulee. At right, O'Donnell is rfed by the giont outlet chonnels which release woter from South Dom into the n Canol of the project. *Photos below by H. W. Fuller, photo at right by F. B.* eroy. *Both ore Region 1 photographers.*

PREPARING FOR IRRIGATION

(PART 4 IN A SERIES OF ARTICLES ON SOILS AND LAND CLASSIFICATION)

by W. W. JOHNSTON, Project Development Supervisor, Columbia Basin Project, Ephrata, Wash.

Two months after the Columbia Basin area was authorized as a Federal irrigation project in the Rivers and Harbors Act of August 30, 1935, a survey force assembled at Ephrata, Wash., to start one of the largest single topographic survey jobs ever to be undertaken. Their first job was to retrace land lines so that section and quarter section corners could be reestablished and provide a clear-cut base for other surveys. Next, topographic maps with a horizontal scale of 400 feet to the inch and a contour interval of 2 feet, were made—a separate sheet for each square mile of project land. These provided data on the surface relief necessary for planning canals, siphons, tunnels, and reservoirs, needed to bring water from behind Grand Coulee Dam to the project lands. The topographic sheets also were used to appraise the topography and as base maps for the land classification—a job that was started in September 1937.

In August 1941, 5 months after the last topographic map had been completed (representing the culmination of about 4½ years of work) the land classification job was finished. The crews had dug 45,000 soil borings and pits to examine soil conditions. Each of these was 5 feet deep except where rock or gravel was encountered closer to the surface. Over 8,000 soil samples were analyzed and over 7,000 tests were made to determine the presence of alkali. All this was done to determine the location and acreage of lands suitable for development as irrigated farms and to further divide these "arable lands" into three classes—class 1 for the best lands, with smooth, gently sloping topography and deep fertile soil, free from alkali and rock and adapted to the production of a wide range of crops; class 2 for the average arable land, which will make good farm land but is inferior to class 1 in one or more respects; and class 3 for the arable land of restricted utility which is inferior to both classes 1 and 2 in one or more respects. The standards for the land classification, which were based on experience with similar lands under irrigation, were established with the aid of a board of consultants composed of Macy H. Lapham, Senior Soil Scientist, United States Department of Agriculture; L. C. Wheet-

PROFILE OF PRODUCTIVITY.—At left, class 1 land in the Quincy Basin—a deep silt loam. Below, class 3 land (3–S) of the West Wahluke Slope—coarse sand and gravel close to surface. Note Saddle Mountains in the background. Markers show depth of pit, numbers indicate location, according to land classifier's map. *Both photos by F. B. Pomeroy, Region 1 photographer.*

, Research Professor of Soils, Washington ricultural Experiment Station; and H. C. vis, a farmer with many years of irrigation ming experience in the Yakima Valley.

An act passed by Congress on May 27, 1937, uired that lands of the project be appraised on basis of dry-land values and that a contract or ntracts be made with an irrigation or reclama-n district or districts to provide for the repay-nt of construction charges before the construc-n of irrigation works could be started.

The land appraisal was made by the same ap-isal board that had appraised most of the ht-of-way for the reservoir behind Grand ulee Dam. The board included three members o had had long experience in land valuation in general vicinity of the project. They were omas F. Roddy and George H. Pfau, of Wenat-e, and S. J. McDonnel, of Soap Lake. The praisal was started in September 1938 and was tually completed by the close of December 1941.

The landowners with aid from the State of ashington Columbia Basin Commission and ne help from the Bureau of Reclamation organ-d the project lands into three irrigation dis-cts in 1939—the Quincy-Columbia Basin irri-tion district, the East Columbia Basin irriga-n district, and the South Columbia Basin irri-tion district, in accordance with the laws of the ate of Washington. Some time later repay-nt contracts were negotiated between the Bu-u of Reclamation and the irrigation districts. e electors voted overwhelmingly in favor of the ntracts on July 21, 1945.

In 1939 Mr. John C. Page, who was then Com-ssioner of Reclamation, realizing that the suc-ssful development of a project so large and ried as the Columbia Basin required considera-n of many factors in addition to the construc-n of the project works, initiated what were to come known as the "Columbia Basin Joint In-stigations." Prof. Harlan H. Barrows, emi-nt economic geographer of the University of icago, Ill., was placed in charge of these inves-gations in collaboration with the Bureau's Mr. illiam E. Warne who later became Assistant ommissioner of Reclamation, then Assistant Sec-tary of the Department of the Interior, and re-ntly a Minister to Iran. Dr. E. N. Torbert th a small staff was located at Ephrata as field ordinator for the joint investigations.

The investigations were truly "joint endeavors."

SURVEYING THE LAND in the heat of the August 1937 summer, using a platform on top of a station wagon to improve the topographic view of the Columbia Basin. *Photographer unknown.*

Some 40 agencies and 90 individuals participated in some degree in the studies which were directed to 28 separate problems.

The joint investigations were independent studies which did not establish policy. However, the findings contributed in a major way to the Columbia Basin Project Act of March 10, 1943, which governs the development and settlement of the project, as far as the Bureau of Reclamation and its contractual arrangements are concerned. Also many of the recommendations were embodied in the repayment contracts, and the reports on the various problems continue to provide guidance as the development of the project proceeds and the project lands are placed under irrigation.

With these basic surveys, appraisals, and studies finished, and with the added benefit of intensive study by a small group of engineers during the war years, the Bureau of Reclamation was prepared to start construction at a rapid pace in 1946 when money and materials began to be available for nonmilitary uses after the close of the war.

NEXT MONTH—The Evolution of Land Classification

PRE-TESTED FARMING

BEST BY TEST.—Hairy vetch proved to be best winter cover crop at Columbia Basin development farms. At present nitrogen prices, a good crop of hairy vetch is worth over $20 per acre for nitrogen alone. ***Photo by H. E. Foss, Region 1 photographer.***

by H. P. SINGLETON, Project Leader, Division of Soil Management and Irrigation Agriculture, United States Department of Agriculture; and Superintendent, Irrigation Experiment Station, Prosser, Wash.

New settlers on the Columbia Basin irrigation project will find that the soil and climate have been pretested—given "trial runs" by a critical group of agricultural research agencies. The farmers will not have to learn all the answers by bitter experience—what crops will grow, what fertilizers are needed, what pests and diseases are waiting for them. For the past 6 years research men of the United States Department of Agriculture and the Washington Agricultural Experiment Stations have been working together with the Bureau of Reclamation putting the basin through its paces.

The "core" of this testing program is the Bureau's system of development farms. Out in the sagebrush, miles from civilization, are scattered pilot farms, irrigated from wells, that are telling the story of the Basin's productivity, its limitations and its farming problems. The Bureau of Reclamation has built these farms in locations selected with the advice of the research agencies so that they represent the soils and climates of large areas of future irrigated land.

From the studies of these farms and intensive laboratory and greenhouse investigations at Experiment Station headquarters, is coming a clear picture of what the new farmer can expect from his farm. It is already clear that the Basin is going to be one of the best irrigated areas of the West. It is also going to have its problems.

Since the program was begun in 1946 a seri of development farms has been established. Th Moses Lake farm was started in 1947, followed 1948 by the Pasco farm. In 1950 the Winchester farm, featuring sprinkler irrigation, was established, and last year the Burke farm joined th group. Still another, in the Othello area, is now being planned. Research work by both the Agri cultural Experiment Station and the Unit States Department of Agriculture on basin pro lems is also being carried out at the Experime Stations, chiefly at the Irrigation Experiment St tion at Prosser, Wash. Here the United Stat Department of Agriculture research group o technicians has its headquarters.

An area as big as the Columbia Basin does no give up all its secrets in 5 years, but already better understanding of this future farming ar is possible. Washington Agricultural Exper ment Station's Bulletin 520 on soil, water, an crop management investigations in the Columb Basin project gives a detailed report of the fi 4 years work. Some of the results of this testi and research program to date are outlined belo

Corn—much more productive than any of th small grain cereals in the Columbia Basin. Th mid-season hybrids are better adapted in gener than the early or late season hybrids. Iowa 93 a representative mid-season hybrid, yielded 1 bushels per acre on land previously in alfalfa a which 160 pounds of nitrogen had been applied previous to seed bed preparation. Wiscon- 416, one of the better early hybrids, produced bushels per acre and U. S. 13, a late hybrid, luced about the same as Iowa 939 but with a h higher moisture content at harvest time.

OYBEANS—22 varieties grown in 1951. Only varieties in the early maturing group show any nise. The yields of these, however, were less one-third the yields of good corn hybrids.

RAIN SORGHUMS—show some promise as a n crop. Yields have approached corn yields ome instances and some varieties of sorghum be harvested with a combine. Double dwarf e sooner and early hegari are good varieties.

MALL GRAINS—as many as 60 varieties or ins of small grains (wheat, oats, and barley) been tested in one season. As a result of e studies, varieties adapted to the Basin are wn to service agencies and seed dealers before arrival of the farmers on the new land.

THER NEW CROPS—safflower, seed flax, and er beans have been tested. Safflower and seed have not appeared to be promising crops to . A 1-year test of castor beans showed that n be grown, but additional studies will have e made to determine whether it can be grown itably.

ITROGEN—when water is first applied to the rt soils of the Columbia Basin a deficiency of ogen is usually the first factor in limiting the luction of nonlegume crops. Results with e nonlegume crops indicate that, with ade- e irrigation water, nitrogen at rates of from to 160 pounds per acre can be used profitably. n where alfalfa has been grown on the new s for 3 years the use of some nitrogen in the egume crops that follow will produce econom- yield increases. Corn on new land has pro- d 140 bushels (shelled corn 15 percent mois-) per acre with 160 pounds of nitrogen, and bushels per acre after 3 years of alfalfa with 80 pounds of nitrogen per acre. Potatoes er similar conditions have produced 15 and 21 of No. 1 potatoes, respectively. Sugar beets ew land have produced yields of 33 tons with pounds of nitrogen per acre.

AIRY VETCH—legume green manure crops are able in supplying organic residues and nitro- and in soil protection. A good crop of hairy h will contain as much as 160 pounds of nitro- in the top growth. At the present price of nitrogen, this top growth of vetch is worth over $20 per acre for nitrogen alone. Hairy vetch is the best winter cover crop that has been tested. It should be planted at the rate of 30 to 35 pounds an acre, generally not later than September 15. The amount of dry matter and nitrogen increases during the time the vetch is allowed to grow in the spring before turning under.

ZINC DEFICIENCY—noted in beans in many new locations in the Columbia Basin in 1951. All of the important soils appear to be subject to the deficiency, particularly where some of the top soil has been removed. The deficiency was comparatively uniform and severe on some fields around Moses Lake where beans were grown following several years of potatoes. Zinc sulphate sprays have produced good results experimentally and are now being used on a field scale. Zinc sulphate was applied as a spray commercially with air and ground equipment on about 5,000 acres of beans in the Yakima Valley and in the Basin in 1951. Growers appear to be well satisfied, but recognize need to improve application techniques.

ZINC DEFICIENCY IN CORN—found in the Moses Lake and Pasco areas. Except in cases of extreme deficiency, which are rare, zinc spray applications have not increased yields. Completion of the analyses of plant samples may help to understand this problem.

In opening up large areas of new land there is a chance to take advantage of disease-free ground and keep diseases out. Surveys reveal which diseases are already present in the area and which ones will most likely come in first. Research is directed towards providing control measures where needed.

CURLY TOP VIRUS DISEASE—will limit production of many crops to varieties bred for resistance. In many cases these resistant varieties are now available or are being produced. Similarly with potato leaf roll, a breeding and testing program is being followed in which satisfactory progress has been made in finding resistance. Much more needs to be done before resistant commercial varieties are available.

POTATO SCAB—may be a problem in most Basin soils. Tests of soil amendments such as sulphur, and new and cheaper soil fumigants, are being conducted along with adaptability tests of new scab-resistant varieties. Other studies are directed towards using green manure crops and rotation systems in controlling the many soil-borne diseases.

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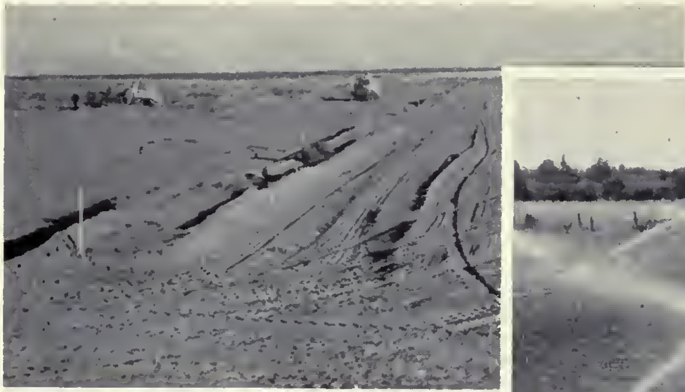


THE NEW "CHIEF ENGINEER"—the former—plans lan leveling or sprinkling programs carefully. Photo at lef F. B. Pomeroy of Region 1. Below, Soil Conservation Service

by JOE BLACK, Columbia Basin Project Farmer whose land will get water in 1952

Getting Ready for the Water

Columbia Basin farmers may pay an average of $85 an acre for construction charges so that water will be delivered to their farms. They will probably spend an equal amount to make certain the water does the job for which it was delivered, and does the job properly.

The farmer may not talk of such things as consumptive use, penetration problems, impervious strata, and water duties, but you can rest assured he has worked with them.

He will want his water to run through the rills or furrows the required distance in the required time without flooding or erosion, and he wants to carry that shovel over his shoulder as much as he can instead of down on his knee and full of mud. He will do this by careful land preparation.

Land leveling, sprinklers, headgates and checks, farm ditches, siphons, spiles, and pipelines will all be used in controlling Columbia Basin water. The type of irrigation system and the extent to which the farmer will prepare his land will be determined both by the type and depth of soil and the finances available to the individual farmer.

Many farmers who have light textured, shallow soil where leveling cannot be done will use sprinkler irrigation. Here the problem is simply the designing and installation of an efficient system, although higher installation costs and later power charges should not be overlooked.

To determine what type of irrigation system is needed, the Columbia Basin farmer will be able to consult with a special group of county agent plus agricultural engineers and other specialists.

A large portion of the land in the Columbi Basin will be prepared for surface irrigation b leveling. The cost of this leveling will vary fro a low of $5 an acre for a simple land plani operation to as high as $100 per acre where hea leveling is done.

Here the large earth-moving machines swit from the construction phase of the project to t land preparation phase. Many farmers start leveling in the fall of 1951, when, it was es mated that over 60 pieces of leveling equipme were working near Quincy, with many more the surrounding areas.

Machines used vary from 16- to 20-yard scrap pulled by large crawler tractors down to fa scrapers or floats pulled by a wheel tractor. T larger machines generally move the bulk of t dirt and leave the finishing operation to t smaller units.

While most of the leveling is done on the ba of hourly rental for the equipment used, some co tractors contract for leveling by the acre or by t yard, with costs running from 15 to 20 cents p yard.

In most cases the leveling is done with the h of cut-and-fill data prepared by one of the vari cooperating agencies, with the farmer marking stakes and checking on the work perform After the leveling is completed, assistance can obtained in laying out the ditch lines. Compl plans of structures are available for the farmers

While the responsibility for the operation falls on the farmer's shoulders, his job is made easier by this assistance. He no longer needs to spend the first year seeing how the water will run. The use of larger equipment has also reduced the final cost. Farmers find it profitable to do the job right in one operation. If a farmer cannot afford the initial outlay for preparing all his farm, he is urged to prepare only a part of it and complete the rest of the farm at a later date.

Land preparation is usually a cash operation and the financial arrangements must be made at an early date in order that leveling can be completed in time for seeding the crop.

Winter weather will halt or at least interfere with a good job of leveling. After spring leveling, the land should be irrigated before planting to settle the ground and replace the surface moisture. The farmer who forsakes a cropping season to level in the summer finds that the dry powdery soil cuts down the efficiency of the equipment and results in higher costs.

Severe wind erosion often follows on the freshly leveled dry soil, and a few aggressive leveling contractors have portable sprinkler systems which can be used to wet the soil down both before and after summer leveling operations. They offer this service to the farmer free, a return from their longer working season.

If we drive down any of the new roads, we see heavy equipment working in the fields, engineers working with instruments and profiles amid the final construction phase of transforming arid land into productive farms, and somewhere amid the confusion or over on the canal bank talking to the ditch rider, we will see the new chief engineer, the farmer. He will be easy to identify, for he will be carrying the tool of his trade, a shovel—"long handle, round point"—ready to stop a leak or turn a little more water down the furrow. ###

MAIN CANAL.—A four-lane water highway on the Columbia Basin project, wide enough to carry four lanes of auto traffic easily with room to spare. Now ready to carry life-giving water to 87,000 acres of land in the State of Washington. ***Photo by H. E. Foss, Region 1 photographer.***

By ROY JOHNSON, President of Sandkay Contractors, and Former Project Manager Morrison-Knudsen Construction Co.

A TREMENDOUS IRRIGATION SYSTEM starts from Grand Coulee Dam, to water more than 1,000,000 acres of the fertile soils of the Columbia Basin. These concrete-lined canals remind you of super highways, or more appropriately, "super water highways." The bottom width of the largest of these canals is wider than necessary for 4 lanes of cross country traffic, and over the entire concrete lined perimeter 12 lanes of traffic could be handled with ease.

That is the picture you get now, but the scene has changed greatly from the time the first survey crews worked from ropes along 100-foot high rock cliff sections to insure a uniform grade to carry the flow of water to its destination many miles away. Next, the construction crews moved

WORLD'S LARGEST PUMPS (above) lift water 280 feet out of the Columbia River, into the Feeder Canal. Farther south the water is held behind Long Lake Dam (at left). Brook Lake in the foreground. *Photo above by H. W. Fuller, at left by F. B. Pomeroy, both Region 1 photographers.*

in with heavy earth and rock-moving equipment to commence carving out the Super Water Highways. Low sections were built up to grade by the use of large crawler tractors and scrapers. The purpose of this type of equipment for the particular phase of the work was the necessity of

MACHINES THAT WALKED A MILE A WEEK.—At left, lining operations in the Main Canal. In the background is the fork where the East Low and West Canals take off from the Main Canal. Below, the West Canal. *Both photos by H. E. Foss, Region 1 photographer.*

aches for the man in charge. Through these sections of lava rock nearly every formation conceivable was encountered. Often we would drill into a clay seam, soft rock or crevice, which made the blasting very difficult. Explosive charges follow the lines of least resistance, and would often follow the clay, soft rock or crevices leaving the hard rock nearly in its original place, requiring redrilling or very slow progress with the large draglines.

After the carving was done with this type of earth-moving equipment to within 6 inches of grade, a specially built earth trimmer and concrete slip form were used. These machines run on a rail placed on each side of the canal, making the over-all span of the machines up to 130 feet. A trimmer with an endless bucket line going around the entire perimeter left a near perfect grade line so as to insure a uniform thickness of concrete. The slip form which then followed spanned the canal in like manner. The concrete was placed in front of the slip form which moved it, vibrating and leaving a finished surface of 4½-inch thickness of concrete, covering as much as 16,000 square yards per single shift.

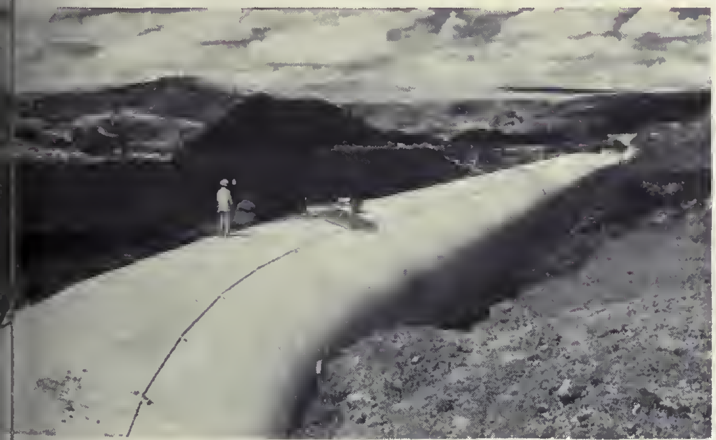
This left the super water highways as you see them today, but you will also find three-mile-long tunnels 25 feet in diameter through solid rock hills, and concrete siphons 25 feet in diameter and 2½ miles long across valleys, all of which help make up a great monument that far-sighted engineers challenged the construction men to build. This monument and others still in the minds of engineers or on drafting boards will make better living for a prosperous progressive country. ###

SUBWAY SYSTEM on the West Canal where water travels underground through dry Coulee siphons No. 1 and No. 2, as part of the 60-mile-long route taken by Columbia River on its way to irrigate project lands. ***Photo by H. E. Foss, Region 1 photographer.***

hauling and placing earth in layers so that it could be compacted to insure a firm foundation for the concrete lining. Draglines with capacities up to 25 tons of earth and rock in a single bucketful were used where compaction was not needed, no embankment was required, and the excavated material did not have to be placed on the canal bank.

The drilling and blasting of rock cuts and cliff sections, which had to be done ahead of the draglines, usually required the greatest number of man hours, as well as the greatest number of head-

CP LAKE SIPHON (below) outside view. At lower right, ...le the Soap Lake siphon, a 25-foot-diameter tube, 2½ ...s long. ***Both photos by H. E. Foss, Region 1.***



Training New Agents

by MEL A. HAGOOD, Leader, Settler Assistance Program, Extension Service, Washington State Colleg stationed at Ephrata, Wash.

"WHERE DO I START?" could well be the typical question of a farmer in any new irrigated area after he has purchased his land. "What should I plant? How much should I fertilize? Where is the best place on my farm to locate my farmstead? How should I irrigate?"

All of these problems that face a new settler any place are facing hundreds of farmers in the Columbia Basin today. Many farmers have worlds of experience in other areas and in areas similar to the Basin, but quite a few have had no irrigation farming experience whatever, or have never faced the problem of starting from scratch to bring a piece of undeveloped land into full production in a short period of 1 or 2 years.

A few bad mistakes in the first few years can be costly to a person starting on limited finances—maybe just costly enough to discourage or completely bankrupt a young family trying to get ahead in the farming business.

Realizing that these mistakes not only are costly to the individual family, but to the community and country as a whole, the State College of Washington and the Bureau of Reclamation have entered into an agreement to provide technical assistance to the settlers in the Columbia Basin through county extension agents especially trained in the field of irrigation farming.

This program is not new to irrigated areas of the West, as similar programs to this have bee in force in Washington on the Pasco pump un and the Roza, and in Oregon on the Owyhee, an North unit of the Deschutes at Madras, as well a many projects in Idaho and other States.

With water being available to 87,000 acres i 1952 in the Columbia Basin for about 900 farm ers, it was obvious to all concerned that the agent who were to help these farmers should becon thoroughly familiar with conditions long befor the needs became critical. Therefore, on July 1951, four county agents in irrigation reported f work at Ephrata to start an intensified trainin program.

These agents were college graduates who ha majored in either soils or agricultural engineerin or any other agricultural field with special em phasis on soils and engineering. In addition, an perhaps more important, they also were require to have actual knowledge gained through living o an irrigated farm. This combination of irriga tion farm background and technical knowled were required to assure a practical approach helping solve the farmers' problems.

Training for county agents is never over, b for the agents working with the settler assistan program, a period of 6 months was designated f special training in phases of agriculture th would affect the new settler.

INTENSIVE TRAINING IN LIVESTOCK PRODUCTION, an important adjunct to irrigation farming, was part of the program for the agents. Below, a dairy scene at Columbia Basin's Winches Development Farm. ***Photo by H. Foss, Region 1 photographer.***

One of the first steps in helping a farmer to start off right is to work out a plan for irrigating the farm unit. To do a complete job it is also necessary to locate the farmstead site, determine what farming enterprises best suit the farm, and above all to know what the farmer himself wants to do in a long-time program. So, first we had to train the agents in engineering techniques such as making topographic maps, staking for leveling, figuring cuts and fills from the profile method, and adequately checking grades for irrigation and ditches. We gave special emphasis to adapting sprinkler and gravity irrigation to different soils and land classifications, as many Columbia Basin farmers will be faced with this problem due to the many wide and varied soil conditions. In keeping with the Extension Service policy of helping folks to help themselves, the agents were trained on the advantages and disadvantages of various methods in order that unbiased information could be passed on to the farmer so that he could make an intelligent decision.

Since the Columbia Basin irrigation project is being constructed and operated by the Bureau of Reclamation in the first phases, it is necessary for the agents to be familiar with all the operations of the Bureau. These include such items as policy of constructing access roads, turnout elevations, land eligible for water, amounts of water available to farms, right-of-way rulings, and methods of delivery. Considerable time has been spent in training the agents in these Bureau policies in order that the information can be passed on to the settlers.

The Extension specialists from the State College of Washington have taken a lively interest in this program. They gave the agents special training in farmstead location and farmstead building arrangement, permitting the agents to work with a particular farm and farm family, to get their viewpoint, as well as that of specialists. The agents spent several days in intensive training on livestock production in the Basin with emphasis on laying out an irrigation plan and field lay-out for livestock production.

They also attended joint meetings with various agencies to help understand the various interlocking activities and lessen confusion.

It is virtually impossible for any one person to be an expert in all phases of farming in the Columbia Basin, but if the farmer can be directed to the right source, he can save time by getting the answer to his problems quickly.

SETTLER ASSISTANTS who have recently come to the Columbia Basin. From left to right, Mel Hagood, leader, a graduate of Oregon State College with experience on the Deschutes project; Roy Deming, University of Idaho graduate who was stationed at Moses Lake after his training period; Gene Thompson, Washington State College, now stationed in Ephrata; Burke Giles, Utah State graduate, now headquartered in Quincy, and Ben Roché, University of California, also stationed at Ephrata. *Photo by F. B. Pomeroy, Region 1.*

First water to the project under gravity was delivered last fall for testing purposes; consequently many newcomers were ready to start leveling and building in anticipation of a big year in 1952. Nearly all requests for assistance were satisfied, and about 25 land-leveling units were kept busy. Trained engineers who had worked in other projects for many years, supervised surveying and layout work.

This year will be a busy one for the agents. Spring brings with it settlers from all over the country wanting immediate help in getting a start in the right direction. Many of the questions are the same with slight variations, which can be answered partially by the "Farmer's Handbook" (see p. 54 of the March 1952 Era).

The primary job of the irrigation agents is to give actual in-the-field help in surveying and laying out an irrigation system. By working along with the farmer, both have an opportunity to discuss all possibilities and angles. The agent knows what the farmer wants, the farmer knows what the agent is doing, and at the same time they both can discuss all other agricultural problems and fit them into the over-all plan. When the work is completed, the farmer has a plan he has helped design, knows the reason for every move and has a good start toward making a success of irrigation farming. ###

VALUABLE TOPSOIL can go with the wind, as graphically indicated at left. Below, Maynard Brown of the Soil Conservation Service consults with a farmer regarding a soils map. *Photo at left by H. E. Foss, Region 1 photographer. Photo below, courtesy of the Soil Conservation Service.*

SAVING THE SOIL

by CECIL McCORMAC, District Conservationist, Soil Conservation Service, Columbia Basin Project, Wash.

In the public interest, the best land use and soil conservation principles are to be applied to land in the Columbia Basin project from the very beginning of the delivery of water to the land.

The Soil Conservation Service is the agency authorized by the Congress to furnish technical assistance in soil conservation. It is charged with the responsibility of preparing land capability information for all farm and range lands in the Nation. It is also responsible for assisting farmers in using their land according to its capability and to treat each parcel of land in accordance with its needs.

In the Columbia Basin, land capability maps have been prepared for the lands to receive water in 1952. A map of each farm unit, showing the various land capabilities for the unit, is available to the owner or operator. The major factors that determine the land capability are slope, soil texture, soil depth, underlying materials, stoniness, and alkalinity or salinity. Combinations of these factors determine the intensity of land use that can safely be recommended.

Treatment sheets have been prepared which furnish information as to the best conservation practices for each land capability unit on the farm. Personnel have been assigned to assist farmers in the on-site planning and application of conservation practices.

Some of the major problems of soil conservation relate themselves to the opening of the land to cultivation under irrigation.

1. In the first place it is necessary to adapt the land leveling program to the effective soil depth of the area to be prepared.

2. Some of the soils of the Columbia Basin are so shallow as to limit sharply, or, in some cases, to prohibit making cuts in land grading for surface irrigation.

3. Another problem of great importance is designing the irrigation system to fit the slope, soil texture, soil depth, and underlying material. On steep slopes or on very light textured soils the length of the irrigation run has to be shortened so that erosive amounts of water do not have to be applied to the furrow in order to reach the lower end of the run within the desired time limit. On light textured soils too long runs result in over-irrigation at the upper end of the run. This leads to water logging and high water tables, which contribute to the drainage problem.

The cropping system to be used in order to mainain or increase organic matter and soil productivity and to prevent excessive losses of soil from erosion is of high importance to conservation of the soil. Some of the steeper, shallower, and sandier soils should be planted to grasses and legumes continuously except for necessary cultivation incidental to reseeding. The percentage of time that a given parcel of land may safely be used for clean tilled crops varies with land capability. One of the major conservation jobs is that of assisting farmers with the development of cropping systems that fit conservation needs of the land as well as being consistent with the type of farm enterprise the farmer wishes to carry on.

The proper application of irrigation water to the land is as important to conservation as the installation of an irrigation system that fits the land. The application of irrigation water at excessively large rates results in severe losses from soil erosion, as well as in large amounts of wasted water.

When the duration of irrigation is longer than is needed to replenish the soil moisture, over-irrigation results, with the consequent waste of water, build-up of the water table, and aggravation of the drainage and alkali problems.

Enough has been said to indicate the scope and nature of the conservation job. The Soil Conservation Service operates through Soil Conservation districts, which are local subdivisions of the State government. They are organized and operated by landowners of the area involved. Each district is governed by a five-man board of supervisors, all of whom are landowners in the district. The Soil Conservation Service furnishes technicians to the Soil Conservation districts to assist in planning and applying soil conservation practices in accordance with land capabilities.

Five Soil Conservation districts have been organized in the Columbia Basin project. Headquarters of the districts are at Ephrata, Quincy, Moses Lake, Othello, and Pasco. Personnel have been assigned to all of the districts having land that will receive water in 1952. Any landowner or operator can get help from the district by applying to the Soil Conservation district board of supervisors.

Land capability maps are available for each farm unit, along with treatment recommendations for each capability class on the farm. Technicians are available to furnish on-site assistance with planning and applying the necessary conservation practices up to the limit of the personnel available to the Soil Conservation Service. ###

Developing a Farmstead

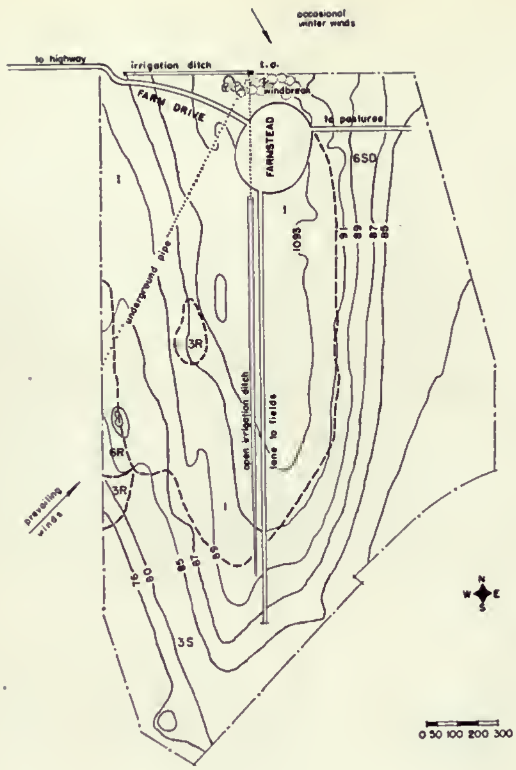
A WELL-PLANNED FARMSTEAD on the Columbia Basin project—farm dwelling, chicken house, and combination garage and machine shed at Pasco development farm. ***Photo by H. E. Foss, Reg. 1.***

by H. E. WICHERS, Extension Specialist in Rural Architecture, Washington State College

Developing a farmstead which will suit the farm family, the farmland, the farm program, and the farm area has always been a problem. Nowadays, with increasing costs for labor and material, we are doing our best to make changes and improvements which will do the job as efficiently and economically as possible.

This is particularly true in the Columbia Basin project where farmers must build many "adaptable" farmsteads in a relatively short time to get new land under production. In some ways new land poses entirely new problems, but essentially, the problems are the same as for any farmstead except for the location of irrigation ditches.

Farmstead arrangement depends upon many things—the owner, the farm and its characteristics, the size, quality of land, farm layout, contours, type of farming, prevailing winds, and lo-



cation of the well, plus any special features for a particular farm.

All of these things taken together determine the location of the farmsite almost automatically. There may be a choice between two or three spots, but the advantages in favor of one or the other can be ironed out as we think the problem over.

Once you know definitely where your site is and what crops you will produce, the farmstead can be simply and logically worked out. List the farm buildings needed and the amount of space needed for each one, then by using a few principles of efficient arrangement, you can figure the layout of the buildings into a pattern that saves time, work and steps, and safeguards health and family comfort.

The house is usually the dominant building as far as appearance from the road or highway is concerned. It should also have dominance over the farm buildings because they are tools for the family's use.

The farm buildings, as tools, should be laid out for easiest use. The buildings most often used should be nearest the house, and other buildings should be arranged in consecutive order of use. It should never be necessary to cross a muddy corral to go from one building to another.

Farm buildings should also be located so that stored machinery is near and accessible to farm lanes leading to the fields. Space for parking the machinery in the farm court near the farm lanes should also be considered.

Each type of farming presents its special problems. Take a poultry farm, for instance. You'll need to follow a rather definite pattern in regard to wind and slope in locating the laying house relative to the house, and the brooder house relative to the poultry house. Drainage from each should be away from the other to prevent spread of disease.

On a dairy farm we have a different problem; we need to consider the milkhouse in relation to the road or highway as well as in relation to the corral. And always we have to keep in mind that the dairy barn should not be too close to the farm house and should be downwind from the house.

An easy way to develop the best possible pattern or arrangement is to map out a flow chart of the work to be done on the farm, showing the logical progression of one job to the next and the shortest distance between the two.

Suppose we work out a definite farmstead arrangement in rough form, using a contour map of plot 167 near Moses Lake, Wash., shown in the upper left hand corner of this page.

First we write in the points of the compass, the road, and the best entry from the road into the farm, depending on the location of an existing irrigation ditch and turnout.

We also spot the direction of the prevailing wind. According to local data this wind is seldom of great intensity, but there is an occasional violent winter wind from the northwest. That knowledge makes it possible to pick out the best spot for the windbreak once we locate the farmstead site.

Next, let's look at the contour of the farm. We note that the land is fairly level. The highest spot is in the north center end of the farm near the turnout. From this high spot, a slight rise runs right through the middle of the farm. The most fertile soil on the farm—85 acres of class 1 land—is smack in the middle of the farm, on and bordering the slight rise. This acreage above will be irrigated. So—this slight rise, sloping gently toward the lower or southern end of the farm will make it possible to irrigate the farm from a ditch leading out from the turnout.

There is considerably poorer land on the border f the class 1 land. This land will undoubtedly used for pasture. So—there should be a con-ction between the farmstead and this pasture. Any irrigation requires a service road along-de. That could be our lane to the fields.

Now, if we locate the farmstead to the west of e windward side of the ditch to take advantage f the drainage for the farm buildings, the pre-iling winds would tend to blow odors from the rm buildings toward the house. It would be tter to place the farmstead to the east or lee-ard of the ditch which supplies the farm with ater. Then we could place our corrals on the oorer land, using some good land for farmstead d garden. The entrance drive would run along-de the ditch if the location of the windbreak d not change our plans.

The final arrangement then is to spot the farm-ead in the circle shown—on or near the high oint of the farm. All corrals, the farmhouse, d other farm buildings would be located on this lot with easy access to the fields and pasture. The rmstead would be on high ground to a point outh of the farmstead to supply the irrigation ith water from the turnout. (It could run nder the farmstead.)

Now, for wind protection, we could place a wind-reak to the east and west of the turnout thus rotecting the farmstead from winter winds. ince the prevailing wind is more of a breeze, spe-al protection is unnecessary except for low berry ushes in the garden.

Next, we indicate the best view on the contour ap and mark a line to locate the driveway.

We have left some space on the farmside of the indbreak for snowbanks. The driveway into e farmstead can go south of that area and on to the farmstead.

With that information on the contour map, it's ot too difficult to decide the location of the uildings. We plot them on sheet of paper to look ke the sketch on this page.

The farm house should go west of the driveway nd 10 feet east of the nearest point of the under-round irrigation pipe. With the driveway laced east of the house, the prevailing winds vill blow the driveway dust away from the house.

We need an all-purpose building—a machine hed, placed so a driveway can go past it to the ane leading to the fields. Then we'll place a loaf-ng shed or animal shelter past, and possibly a ttle south of, the machine shed. Whether the owner goes into beef or dairy cattle, the loafing shed will work in either case. We'll need a lane to the pasture not too far from this loafing shed and to the north of it. North of the lane to the pasture we can mark in a small chicken house, and a garden plot west of the house.

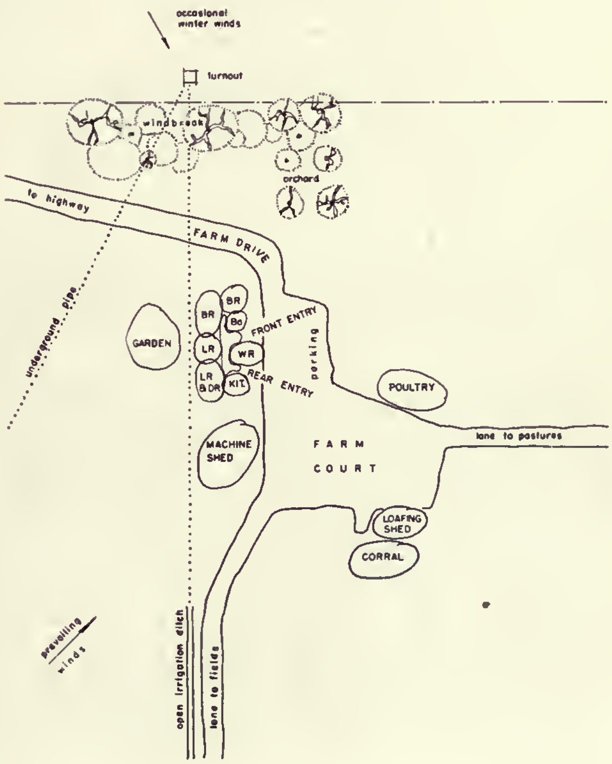
We don't have to worry about the location of the well, as water will be piped in from a neigh-bor's well on the north.

The school bus will run along the road. The power line will be along the main road and come down the drive to a point just beyond the turnout and then to a meter pole not far from the machine shed. The telephone line follows this same route.

There you have the whole plan arrangement. It's individual and based on existing conditions.

As plans for each building develop, we can de-termine their exact location and their exact rela-tionship one to the other. But the general posi-tion has been determined and will make it easy to work on a farmhouse plan or any other farm building plan.

The location of the drive, the parking lot, the view, the slope of the ground, the location of the farm buildings all contribute to spotting en-trances and rooms in the farmhouse itself just as they determine the plan and location and openings into other farm buildings. ###



Credit for Settlers

GROWING A FARMSTEAD.—H. D. Bair, Jr., on unit 68 of the Rosco unit, Columbia Basin project, starts in a tent, builds his first "house" of concrete blocks. Loter it will be o goroge *Photo by H. E. Foss, Region 1 photographer.*

by CARL E. LARSON, County Supervisor, Farmers Home Administration, Pasco, Wash.

The Pasco pumping unit, which was the first unit of the Columbia Basin project to come under water, was opened up for settlement in 1948. Three or four settlers raised a crop during the year; however, it was late in 1948 and early in 1949 when the bulk of the new settlers began moving in.

Most of these settlers are veterans and their families who have moved in from other States in the West, the mid-West, and South, with their household goods and farm equipment. The first thing they had to do was to build some type of shelter for themselves—a tent, a shack—or rent a place in town until a small house could be built. Usually the first shelter was a building which could later be converted into a garage or a chicken house.

After the families were settled, the next order of business was to make plans for developing an irrigation system, cropping programs, domestic water, and credit. These veteran families had a net worth of approximately $7,000 on an average. However, as this was not enough to take care o the development needed, a source of credit had t be explored. Since these families were not know locally and had a great deal of expense ahead o them, the private lending agencies were not ab to give them enough long-term development cred to be of any help at this time. That is why th Farmers Home Administration was called upo to provide credit for these settlers to develo these farms. Whenever a settler reaches a poi where his resources are such that private lendin agencies can take over, the settler agrees to re nance his indebtedness to the F. H. A.

We have four types of loans that were used this project:

1. Production and Subsistence Loans (co monly called farm-operating loans) for the pu chase of necessary equipment, livestock, feed, see fertilizer, and other necessary farm and hom operating expenses.

2. Water Facilities Loans, to provide need facilities for water storage and use in the ar

nd semiarid areas of the 17 western States. These loans can be made for the development of domestic water systems or irrigation systems.

3. FARM OWNERSHIP LOANS—for over-all development of the farm such as buildings, irrigation systems, etc.

4. FARM HOUSING LOANS—for constructing and repairing farm houses and other farm buildings.

A total of $802,020 has been loaned since the beginning of the project, and $254,308.03 has been repaid during the same period. The break-down on the total amount loaned is $379,855 for production and subsistence loans, $204,555 for water facilities loans, $186,735 for farm development, and $30,875 for farm housing.

Approximately $100,000 of the $802,020 which was loaned this winter to purchase equipment, livestock, and provide operating expenses for the 1952 crop year will not be due prior to the fall of 1952. Also included in this total is $58,000 loaned to the group to develop a domestic water system. This system will provide approximately 50 families with domestic water for farm and home use—one of the great problems in settling a new project.

Here is a typical example of a Pasco family. When they arrived at Pasco, they had a net worth of about $6,500 and immediately put up a tent to live in, until they bought an old house and had it moved to their farm. Shortly after this they got a development loan of $12,000 to complete the house, drill a well, build a barn to meet grade A specifications and install a sprinkler system to cover about 80 acres. They got another $3,000 on a production and subsistence loan for operating expenses and additional equipment. The land was cleared of sagebrush and planted to alfalfa, pasture, clover for seed, and about 15 acres to Red Mexican beans for a cash crop. Today this farm is all in hay and pasture and the family has 20 head of Holsteins producing a little over 400 pounds of butterfat. They also have 30 head of young stock of various ages coming on which in about 2 or 3 years should allow for a herd of about 35 milk cows. They are current on their obligations although they do owe in the neighborhood of $19,000. This year they sold approximately 70 tons of hay plus furnishing feed for their own herd. This is one of the better farmers who has had a lot of dairy experience plus a college education in agriculture.

This project, I believe, has provided a good opportunity for the young family who has farm experience, a reasonable amount of capital and is willing to get out and work hard. Above all, the wife has to be able to withstand the inconveniences, discomfort, and hard work connected with settling new land. ###

FROM TENT TO "DREAM HOUSE."—Mr. and Mrs. Robert Tschirky and their daughter Yvonne on unit 32, started out in a tent. The photo at left was taken in April 1949. Below, 1 year later, Mr. Tschirky, with the help of his neighbors, had built this attractive two-bedroom home. Timely FHA loans helped similar Pasco settlers off to a good start. *Both photos by H. E. Foss, Region 1 photographer.*

MILLIONS OF GEESE at Long Lake (at left). Below, Long Lake Dam and Reservoir, a large preserve for waterfowl. *Photo at left by Ralph Bennett, below by H. E. Foss, both of Region 1.*

COLUMBIA BASIN WILDLIFE POSSIBILITIES

by EUGENE MAXWELL, District Supervisor, Department of Game, State of Washington

HERE IS SOME IDEA of what can be expected in the way of benefits to game in the Columbia Basin with the completion of the Columbia Basin project. This deals only with waterfowl and upland birds.

Generally speaking, the abundance of waterfowl in any given area is governed by the food supply and the amount and type of water available for feeding, resting, and rearing of young. Any deficiency or improvement in meeting these requirements affects the number of birds for the autumn harvest.

With the completion of the Columbia Basin project, the amount of available water for waterfowl will be increased manyfold. Desirable habitat will certainly increase and only a small amount will be lost. The two most important areas affected adversely will be the potholes south of Moses Lake, and Lewis and Devils Lakes north of Coulee City.

The potholes area, which will be inundated by the back-water created by the O'Sullivan Dam, will not be a complete loss, however. The surface acreage of water will be increased, and Bureau of Reclamation engineers estimate that water will seep through the west bank of the new impoundment and thus create small potholes among the existing sand dunes which will provide ideal breeding areas for ducks. The much longer shoreline should form nearly as many potholes for duck production as before.

In 1949 State game department personnel estimated there were approximately 889 potholes and lakes in that area designated as the Potholes, south of Moses Lake. This survey, made by air, was followed by a 5 percent sampling of the area on foot, in order to determine as closely as possible the number of waterfowl produced during that summer. This ground survey disclosed that an estimated 21,200 ducks were produced in the potholes area.

Some presently valuable duck-producing habitat will be lost when Lewis and Devils Lakes north of Coulee City are inundated as the water level in the equalizing reservoir rises. However, even though stabilized plant growth along its banks will be impossible to achieve due to the fluctuation of the reservoir, this body of water will be valuable to waterfowl as a resting place for birds during migration.

The construction of many miles of irrigation canals, wasteways, and drain ditches will add immeasurably to the habitat available to ducks. Studies in the Yakima and Kittitas irrigation districts prove this. For example, in 1949 approximately 244 miles of drain ditch averaged 2.6 duck broods per mile. Irrigation canals in the Yakima Valley produced one brood per mile during the same year, and canals in Kittitas County averaged three broods per mile. In general, the drain ınals and wasteways provide better duck habitat ıan the main canals since many of the latter are ·ment lined and therefore do not allow as much ·epage for the growth of vegetation, nor easy ccess to and from the water.

Goose hunting has improved in the Columbia Basin since the flooding of the area behind Long ake Dam, which included the Stratford reserve. eese had previously used Stratford Lake as a efuge, and last year thousands of additional irds used the area. As geese are primarily grazrs and feed largely in wheat fields during the ıll months, the nearby grain fields provide adeuate feeding areas. An increased kill of geese uring the 1951 season in the Basin reflected this ıcrease in habitat.

Upland game birds found in the Columbia asin include the pheasant, valley quail, chukar artridge, Hungarian partridge and sage hen. he Reclamation project should not greatly alter ıe habitat of the chukar and the sage hen since oth species frequent the higher sagebrush areas. he habitat of other birds will be greatly ineased. These species, known as "farm game," nd preferred habitat on irrigated lands. They re found in only fair quantities in the Columbia asin at the present time, due mainly to the lack f suitable cover, food and water. Their food onsists of weed seeds, cereal grains (mostly waste rain) and grasses. Insects and wild fruits are ·adily taken in season.

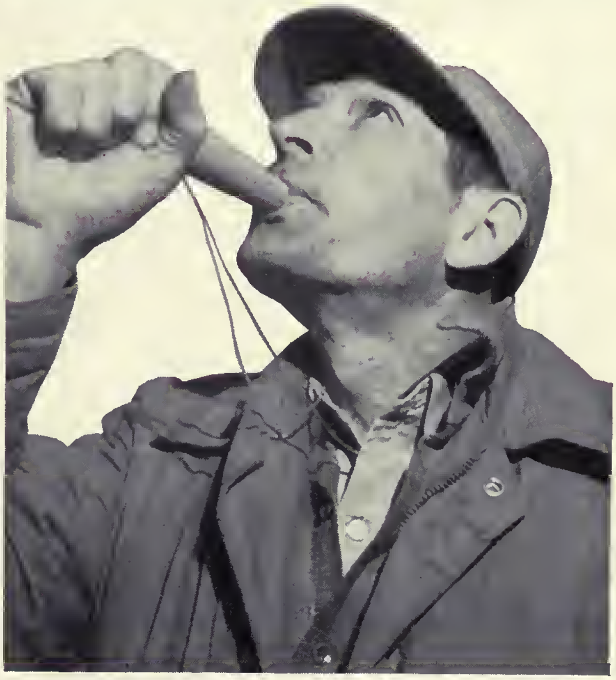
For a number of years the department of game as had a fair check on the number of pheasants illed in the State. In addition to a legal hunt- ıg license, the department issues "punch cards") hunters, who are required to keep tally of the umber of pheasants they kill and return the unch cards to the department at the close of the ·ason. The returned cards help to determine ıe number of pheasants killed in the State, and ı various counties. In 1949, a double-check was ıade by sending a questionnaire to 1 percent of ıe hunting license holders.

The irrigated areas of Yakima and Kittitas ounties have ranked high in pheasant production nd kill for many years as well as for duck habiat. Yakima County consistently ranks first in nnual kill and Kittitas County ranks third or ourth, alternating with Spokane County. In)49 the pheasant kill in Yakima County was 81,- 24 birds. Kittitas County, with its smaller acrege of farm lands, ranked fourth with 25,251. During the same year Grant County had a kill of 8,456 pheasants. When one considers the number of acres of habitat that will be made available to pheasants in the Columbia Basin compared with the acreage of habitat in Yakima and Kittitas Counties, it is easy to predict that pheasant production and kill could easily surpass these figures in years to come.

Upland bird production will be stepped up as soon as cover is increased. Habitat areas under State control should be selected for the improvement of cover and must be exempt from grazing by livestock. These tracts should be selected mostly from class 6 land in low lying areas where they can be irrigated with waste water from surrounding farms. With the possibility of some lands being set aside as public hunting areas for waterfowl, such lands can readily serve a twofold purpose: hunting and year-around cover for both upland birds and waterfowl.

This is the first time the Washington State Game Department, functioning as a State organization, has had the opportunity to plan on the recreational potentialities of any new area. It is therefore necessary to explore every possibility within or on the perimeter of the Columbia Basin so that the people of this State can enjoy the recreation derived from wildlife production. ###

GIVING THE GOOSE CALL on the Columbia Basin on the opening day of the 1951 season is Ted Ahl of Seattle. ***Photo by Ralph Bennett, Region 1, October 27, 1951.***



WATER'S ON THE WAY! At left, water on the way to Columbia Basin farms via the West Canal. Below, H. A. Parker. *Photo at left by H. E. Foss. Photo below by F. B. Pomeroy. Both are Region 1 photographers.*

LOOKING AHEAD

by H. A. PARKER
District Manager
Columbia River District
Ephrata, Wash.

Bulldozers, carryalls, power shovels, and other heavy equipment have been scratching at the surface of the earth for almost 20 years now in the several-thousand-square-mile area designated as the Bureau of Reclamation's Columbia Basin project. Even now, we are able to say only that the construction phase of this largest single reclamation development in the Nation is little more than 60 percent completed.

The Grand Coulee Dam is built. The world's largest power plant, with a rated capacity of 1,974,000 kilowatts is capable of supplying almost 40 percent of all the existing hydroelectric power in the Pacific Northwest. Yet the most vital phase of the 1,029,000-acre project is only now beginning.

This is the starting of settlement. The dramatic benefits that this project can give to the Nation will only begin to be felt in their entirety in the next 20 years. For here today are benefits that we can understand in terms of human values—homes and opportunities for veterans who are able to farm and own their own land.

The Bureau of Reclamation is providing homes and livelihood. Equally important, it is providing, through this project particularly and elsewhere through similar undertakings, a market for the materials exported from every State in the Nation.

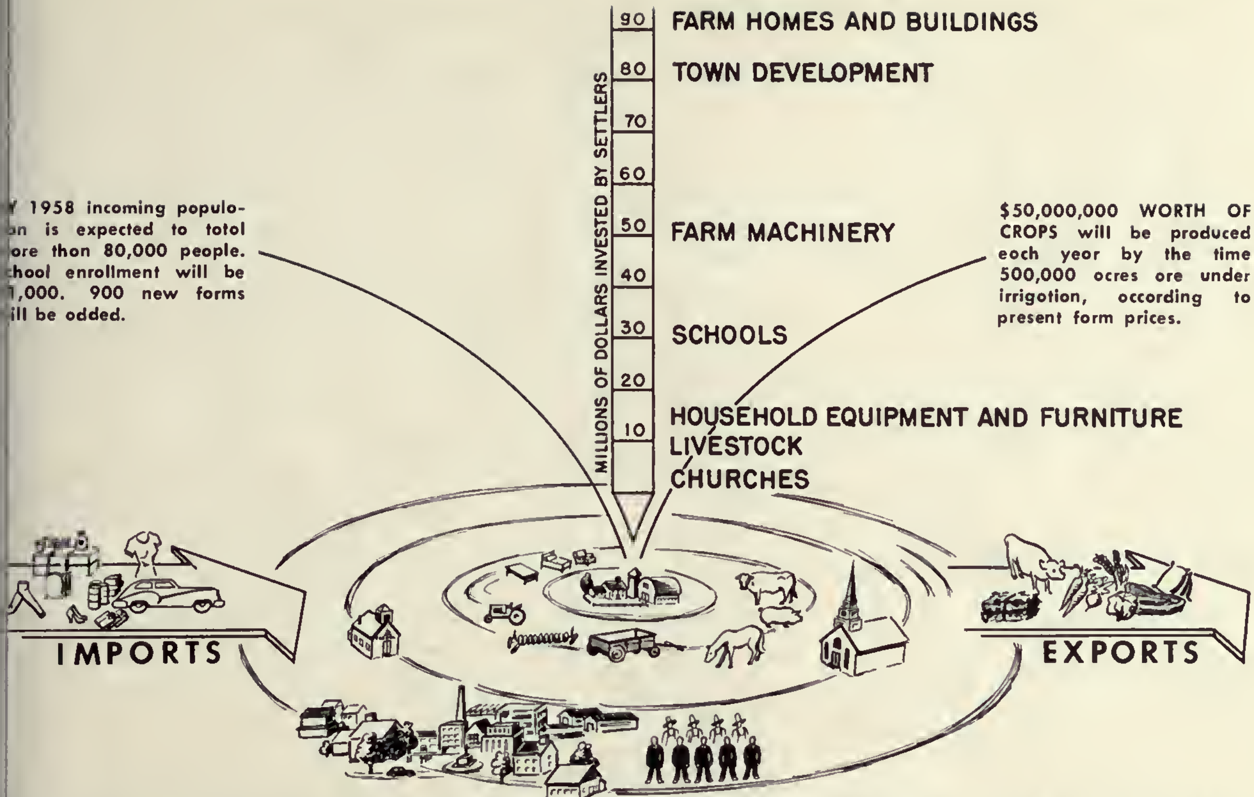
Following are just some of the investments that new settlers will have to put into their property to establish homes and transform sagebrush land into irrigated farms. The figures are supplied by the economics branch of our project development division, after an exhaustive study of the potentialities of the area.

These figures are for the development of only the first 500,000 acres, or approximately one-half of the total project:

$49,520,000—farm machinery.
$90,373,000—farm homes and buildings.
$80,000,000—town development.
$8,000,000—livestock purchases.
$10,000,000—household equipment and furniture.

These are only a few of the total number of items. The incoming population is expected to total more than 80,000 by the end of 1958 and about 200,000 by the time the total settlement is completed.

School enrollment will jump 21,000 by 1958 with expenditures of approximately $29,400,0[illegible] for school facilites by that time.



AT HALFWAY POINT

WHEN THE FIRST 500,000 ACRES, or approximately one-half of the total Columbia Basin project, have been developed, new settlers will have invested almost a quarter of a billion dollars in the items designated above—representing $237,893,000. The simplified diagram indicates the approximate amount of the investments for specific items—not an accumulated total. *Drawing by Lloyd Chellman, Graphics Section, Washington, D. C.*

Church groups are busy surveying for their fu-ure needs, and one estimate by a group repre-enting 22 denominations placed the building fig-re at $1,000,000 for these denominations alone n the next 10 years.

About 900 new farms will be ready for water to ow over them each year for the next 7 years.

By the time 500,000 acres are being irrigated, he value of farm crops produced will be approxi-nately $50,000,000 each year, based on 1950 prices.

This is just the start of what is going to hap-en in the next 10, 15, or 20 years, and which there-fter will be a continuing source of wealth to the ational economy.

These settlers will be the market for future auto-nobiles, homes, sewing machines, dish washers, lothing, and thousands of other items.

For each group of four new settlers on the land, t is estimated that the livelihood for five persons s provided in some nearby town.

So we might say that the effect of the Columbia Basin project on the future is like that of drop-ing a pebble into a still pool. Ever-widening ipples will extend from this project to the State of Washington at large, to the Pacific Northwest, to every State, and to the combined economy of the entire United States.

The benefits and lessons learned from this proj-ect, in turn, will spread to future projects. Many parts of the Nation and many persons who 20 years ago had never heard of Federal Reclamation now know of the works that are being built to benefit the Nation here.

No one can predict the future for Reclamation, but perhaps because of what is happening on the Columbia Basin project this year, 50 years from now, people will look back on a hundred years of bringing semiarid land under cultivation and think, just as we are thinking today of the Co-lumbia Basin project:

"We're just a little more than at the half-way point. This is only the beginning!" ###

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NOTES FOR CONTRACTORS

Contracts Awarded During February 1952

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DS-3600	Missouri River Basin, Colo.-Kansas-Nebr.	Feb. 12	Very high frequency FM radio equipment for Kansas River District, schedule 2.	General Electric Co., Syracuse, N. Y.	$19,71
DC-3603, DC-3604, and DC-3605.	Missouri River Basin, S. Dak.	Feb. 13	Construction of Brookings, Groton, and Summit substations.	D. A. Gill Co., Inc., Sioux Falls, S. Dak.	120,8
DS-3608	Colorado-Big Thompson, Colo.	Feb. 15	Two 84-inch butterfly valves with operating units and handling equipment for Flatiron power and pumping plant, schedule 1.	Willamette Iron & Steel Co., Portland, Oreg.	155,9
DS-3609	Davis Dam, Ariz.-Nev	Feb. 1	1 main control board for Prescott substation	Berry Engineering Co., Long Beach, Miss.	18,7
DC-3613	Columbia Basin, Wash	Feb. 15	Construction of Lower and Upper Saddle Gap and PE-17 pumping plants, lateral PE-16.4 pipe siphon in area P-1, and laterals in P-13.	Intermountain Plumbing Co., Inc., and Henry L. Horn, Connell, Wash.	852,
DS-3615	Central Valley, Calif	Feb. 29	One 275-ton traveling crane and 1 lifting beam for Folsom power plant.	Judson Pacific-Murphy Corp., Emeryville, Calif.	209,73
DC-3618	Gila, Ariz	Feb. 28	Construction of earthwork, concrete lateral lining, and structures for unit 1, Mohawk distribution system.	Macco Corp., Paramount, Calif	1,099,
DS-3621	Eklutna, Alaska	Feb. 14	1 variable-diameter penstock with two 51-inch inside diameter branches for Eklutna power plant, schedule 2.	Southwest Welding & Manufacturing Co., Alhambra, Calif.	235,5
DS-3623	Cachuma, Calif	do	57,000 barrels of bulk portland cement for construction of Tecolote tunnel, schedule 1.	Monolith Portland Cement Co., Los Angeles, Calif.	211,
DC-3626 and DC-3627.	Missouri River Basin, S. Dak.	Feb. 11	Construction of Armour and Tyndall substations	Donovan Construction Co., St. Paul, Minn.	83,1
DS-3628	Eklutna, Alaska	Feb. 12	One 7.08- by 9-foot fixed-wheel gate leaf for surge tank of Eklutna pressure tunnel, item 1.	Johnson Machine Works, Inc., Chariton, Iowa.	11,8
DC-3629	Columbia Basin, Wash	Feb. 13	Construction of Lake Lenore pumping plants Nos. 1 and 2 and intake and connecting channels.	Duncan Construction Co., and Commercial Builders, inc., Moscow, Idaho.	158,20
DC-3630	Deschutes, Oreg	Feb. 4	Construction of cut and cover conduit structure in the channel of existing North unit main canal.	G. T. Gentle, Portland, Oreg	63,81
DC-3631	Columbia Basin, Wash	Feb. 7	Repair of floor slabs in Feeder canal pump discharge outlet transition.	Cherf Bros. Construction Co., Ephrata, Wash.	64,35
DC-3632	Boulder Canyon, Ariz.-Calif.-Nev.	Feb. 14	Construction of earthwork, pipelines, and structures for laterals 97, 98, 99.4, and 99.8-0.51, and sublaterals, part 2 of unit 9, Coachella Valley distribution system, All-American Canal system.	R. V. Lloyd & Co., Coachella, Calif.	1,598,7
DC-3633	Missouri River Basin, Kans.	Feb. 8	Construction of Kirwin Dam foundation	Cook Construction Co., Jackson, Miss.	1,226,2
117C-119	Columbia Basin, Wash	Feb. 7	Roosevelt memorial at Grand Coulee Dam	George V. Nolte & Co., Bellingham, Wash.	34,3
117C-132	do	Feb. 8	Permanent residences, garages, shop, and utilities at Royal O & M headquarters.	Van Werven & Van Andel, Lyden, Wash.	191,2
117C-133	do	Feb. 11	Lateral extensions in areas E-2 and E-3	Minnis & Shilling and United Concrete Pipe Corp., Moses Lake, Wash.	34,0
200C-187	Central Valley, Calif	Feb. 19	Shasta Dam-Buckeye water line	Coast Construction & Excavating Co., and Jeske Bros., Eugene, Oreg.	37,7
300C-31	Davis Dam, Ariz.-Nev	Feb. 5	Construction of railroad spur for system O & M area at Phoenix.	T. A. Kvale and L. L. Driggs, Phoenix, Ariz.	16,9
703C-230	Kendrick, Wyo	do	Streets, sidewalks, drainage, sewage, and water distribution systems at Alcova Dam Government camp.	Lundon Construction Co., Casper, Wyo.	125,3

Construction and Materials for Which Bids will Be Requested by June 1952

Project	Description of work or material
Cachuma, Calif	Construction of 18- by 65-foot concrete Lauro control house with open 140- by 34-foot concrete pit for control valves; installation of chlorinating equipment, steel pipe, valves, and meters; and 500 feet of 154-inch diameter buried steel pipe for Lauro dam outlet works. The control house is located at Santa Barbara, Calif.
Central Valley, Calif	Construction of 19 miles of 12- to 36-inch diameter reinforced concrete and concrete irrigation pipe lines for the Stone Corral irrigation district on the Friant-Kern canal distribution system.
Do	Construction of 14 miles of main lateral of 340 to 278 cubic feet per second capacity and 20 miles of sublaterals of 85 to 15 cubic feet per second, near Madera, Calif.
Do	Construction of 43 miles of pipelines for Exeter irrigation district on the Friant-Kern canal distribution system.
Do	One 3,000-ampere, 13.8-kilovolt air circuit breaker for Folsom power plant.
Do	Station service unit substation for Folsom power plant.
Do	Main control board and auxiliary control and graphic board for Folsom power plant.
Do	Three 3,000-ampere, 15-kilovolt, isolated phase bus structures, with current and potential transformers, lightning arresters, and capacitors for Folsom power plant.
Do	One 4,160-volt unit substation switchgear having compartments for the following: one 5,000-kilovolt-ampere, 4,160-volt incoming circuit; one 1,000-kilovolt-ampere, incoming circuit; and seven 4,160-volt outgoing circuits for Folsom switchyard.
Central Valley, Calif.—Continued	Construction of the semioutdoor type 14,000-kilow Nimbus power plant to house two 7,500-kilov ampere generators, and the concrete Nimbus di sion dam on the American River about 7 miles fr Folsom, Calif. The dam is to be 22 feet high and feet long with eighteen 40- by 24-foot radial gates.
Do	One 60-ton gantry crane for Nimbus power plant.
Do	Embedded metalwork for eighteen 40- by 20-foot ra gates for Nimbus power plant.
Do	Traveling water screens for Delano-Earlimart irrigat district No. 2.
Do	Vertical-shaft, motor-driven pumping units of the lowing capacities: two 7.5 cubic feet per second, 4 cubic feet per second, and one 2 cubic feet per seco at 25-foot head for pumping plant D-3; two 4 c feet per second and one 2 cubic feet per second a foot head for lateral 115.8W pumping plant; one 6 bic feet per second, one 4 cubic feet per second, one 2 cubic feet per second at 13-foot head for la 121.0W pumping plant; and one 4 cubic feet per sec and two 2 cubic feet per second at 18-foot head fo eral 118.1W pumping plant on unit 2 of Del Earlimart irrigation district.
Do	Construction of 9,200 feet of 19-cubic feet per se capacity reinforced concrete pipeline for latera for Contra Costa County water district on the Co Costa canal. Pipe varies from 30 to 24 inches i ameter under heads up to 125 feet.

Construction and Materials for Which Bids Will Be Requested by June 1952—Continued

Project	Description of work or material
[Colu]mbia Basin, Wash.	Completion of electrical installation in industrial area, machine shop, warehouses A and B; removal of existing heating plant; and installation of Feeder canal gaging equipment at Coulee Dam, Wash.
Do	Construction of 3 miles of distribution system of 2 to 5 cubic feet per second capacity for part-time farm units in block 41, lateral area E-2 on East Low canal, near Moses Lake, Wash.
Do	Construction of 6,200 feet of type A barbed wire fence, gates, and 12 ladder rungs on Potholes East canal.
Do	Vertical-shaft, motor-driven pumping units of the following capacities: three 39.3 cubic feet per second at 14.5-foot head for Ringold relift pumping plant; one 7 cubic feet per second at 32.5-foot head for PE-62 pumping plant; two 11.5 cubic feet per second at 30-foot head for PE-64 pumping plant; 1 cubic feet per second at 20-foot head for PE-64 relift pumping plant; one 3.2 cubic feet per second at 18-foot head for PE-64C pumping plant; and two 9 cubic feet per second at 52-foot head for PE-65 pumping plant on Potholes East canal.
Do	Installation of two 65,000-horsepower, 720,000 gallons per minute pumps No. P5 and P6 in Grand Coulee pumping plant; miscellaneous metalwork and electrical installations for Grand Coulee Dam, pumping plant, and power plants.
[Dav]is Dam, Ariz.-Nev.	Completion of architectural finish and miscellaneous metalwork for Davis Dam and power plant.
Do	Erecting steel structures, installing electrical equipment, and constructing control house at Prescott substation.
[Ede]n, Wyo.	Construction of 0.42 mile of 475 cubic feet per second capacity earth-lined Means canal; enlargement and rehabilitation of 6.5 miles Eden canal to 300 cubic feet per second capacity, part of which is to be lined; construction of 2 miles of Eden canal laterals, 20 to 5 cubic feet per second capacity; and relocation of 0.35 mile of Dry Sandy Creek channel, 670 cubic feet per second capacity, about 44 miles northwest of Rock Springs, Wyo.
[Ekl]utna, Alaska	Construction of the 2-unit 30,000-kilowatt Eklutna hydropower plant near Palmer, Alaska. The powerhouse superstructure will have steel framing and concrete curtain walls; either wood piles or concrete caissons will be required for the foundations. The structure will measure 71 by 74 feet in area and 50 feet in height from generator floor to ceiling. The contractor will install two 21,000-horsepower Government-furnished turbines and a 40-ton traveling crane. Switchyard steel structures, to be furnished by the contractor, will be installed on the roof of the power plant. A machine shop similar in construction to the powerhouse will be built adjacent to the powerhouse.
Eklutna, Alaska—Con.	Main control board, distribution board, and battery chargers for Anchorage substation.
Fort Peck, Mont.-N. Dak.	Construction of 115/12.47-kilovolt Dawson substation at Glendive, Mont., involving erecting steel bus structures, installing Government-furnished major electrical equipment, and furnishing and erecting warehouse and service buildings.
Kendrick, Wyo.	Placing earth lining on a reach of lateral, 15 miles southwest of Casper, Wyo.; compacting bottom and banks and placing gravel cover on about 3,000 feet of lateral, 20 miles southwest of Casper; and constructing seven drainage inlet structures, 8 miles west of Casper.
Do	Placing asphaltic membrane lining on about 6,000 feet of existing lateral in Natrona County, Wyo., 5 miles west of Casper, Wyo.
Do	Two 15,000-volt metal-clad switchgear assemblies for Alcova power plant.
Do	Main control board extension and auxiliary control and graphic board for Alcova power plant.
Palisades, Idaho	Construction of permanent Government camp about 56 miles southeast of Idaho Falls, Idaho. The contract will include twenty 3-bedroom temporary houses, twenty 2- and 3-bedroom permanent houses, 1 office building, 1 dormitory, 1 garage and warehouse, one 12-car garage, facilities for 25 trailers, and streets, walks, sewers, and water mains.
Missouri River Basin, Nebr.	Construction of 7,500-kilovolt-ampere Ogallala substation requires concrete foundations; erection of all structural steel; installation and connection of all electrical equipment furnished by the Government; and erection of a 16- by 20-foot control house.
Do	Construction of 10,000-kilovolt-ampere Chadron substation requires concrete foundations; erection of all structural steel; installation and connection of all electrical equipment furnished by the Government.
Missouri River Basin, N. Dak.	3 single-phase, 26,667-kilovolt-ampere autotransformers for Jamestown substation; one 3-phase, 15,000-kilovolt-ampere transformer for Washburn substation.
Missouri River Basin, S. Dak.	One 3-phase, 300-kilovolt-ampere transformer for Watertown substation.
Riverton, Wyo.	Construction of a permanent check near Wyoming tunnel; construction of Wyoming lateral structures; and construction of Cottonwood drains.

United States Department of the Interior, Oscar L. Chapman, Secretary

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THE RECLAMATION AREA

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FEATURE ARTICLES

SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1.50 a year for persons residing in the United States and Canada; $2 a year for foreign subscriptions; special rate of $1 a year for members of water users' associations, and Bureau of Reclamation employees. No stamps, please!

OUR FRONT COVER

A typical irrigated spread producing a hay crop in the Milk River project for livestock feeding. Photo by Donald H. Demarest, former Region 6 photographer.

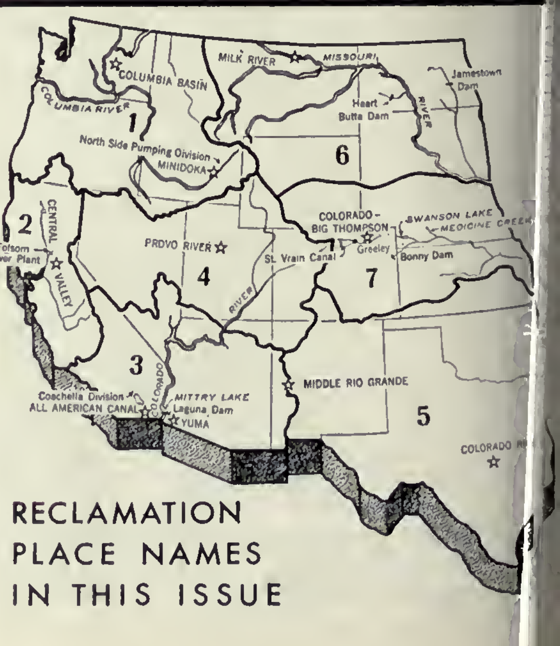
35 YEARS AGO IN THE ERA

Food Crops Must Be Increased

by Hon. D. F. Houston,
Secretary of Agriculture

The importance to the Nation of a generously adequate food supply for the coming year can not be overemphasized in view of the economic problems which may arise as a result of the entrance of the United States into the war. Every effort should be made to produce more crops than are needed for our own requirements. Many millions of people across the seas, as well as our own people, must rely in large part upon the products of our fields and ranges. . . . Recognition of the fact that the world at large, as well as our own consumers, must rely more strongly on American farmers this year than ever before should encourage them to strive to the utmost to meet these urgent needs.

(From Page 231 of the May 1917 issue of the *Reclamation Record*, predecessor to the *Reclamation Era*.)



RECLAMATION PLACE NAMES IN THIS ISSUE

The Valley of the Milk River

Part 1—Development of the Project

MILK RIVER BASIN, with the St. Mary River visible at upper left, (1) Sherburne Lakes Reservoir, (2) St. Mary Canal, (3) Fresno Reservoir, (4) Dodson Diversion Dam, (5) Nelson Dam, (6) Vandalia Diversion Dam, and (7) Fort Peck Dam. *Artwork on relief map by Graphics Section, Washington, D. C.*

by B. E. GARLINGHOUSE, Superintendent, Milk River Project, Malta, Mont. Region 6 (headquarters in Billings, Mont.)

ON THE MILK RIVER PROJECT, close to the Canadian border in northern Montana, the ranchers and farmers are gradually developing an ideal agricultural setup, combining irrigation and dryland farming, with available grazing units, to provide a stabilized enterprise.

Ever since the first cattlemen and sheepmen drove their herds across the Missouri River into the Milk River Valley in the 1880's, the range livestock industry has been well established in this area. Irrigation farming is not new, either, although it really began to come into its own around 1940 after the Fresno Dam was completed, providing carryover storage within the project. Up to that time, the Milk River project received its water from the Sherburne Lakes Reservoir on the St. Mary River in Glacier National Park 400 miles west as the crow flies. The water used on the project is a mixture of the flow of two international streams, the St. Mary and the Milk Rivers, both of them having their drainage basins in northern Montana and Alberta, Canada. The St. Mary rises in Glacier National Park and flows north into Hudson Bay via the Saskatchewan River. The Milk River's North Fork and the South Fork also begin in the United States in the rolling country immediately northeast of the St. Mary Basin. The two forks of the Milk River flow north, meet in Canada, travel east about 216 miles above the border, and reenter the United States to meander through the Milk River Valley on its way to the Missouri River.

St. Mary river water is stored in Sherburne Lakes Reservoir, transported through a 29-mile

LATE NEWS BULLETIN: As this issue goes to press, Milk River floods are decreasing, although warm weather holds danger of snow melt from the mountains to the north. Damage has been extensive. Some canals have washed out, pumping plants are completely covered with water, diversion dams are submerged, and farm families and livestock have been evacuated to higher ground.

Downstream, below Fort Peck dam, the ice jam in the Missouri River broke on April 3, freeing the flood waters which had covered the entire west bottom of the Buford-Trenton project.

Estimates of flood damage cannot be made until water recedes.

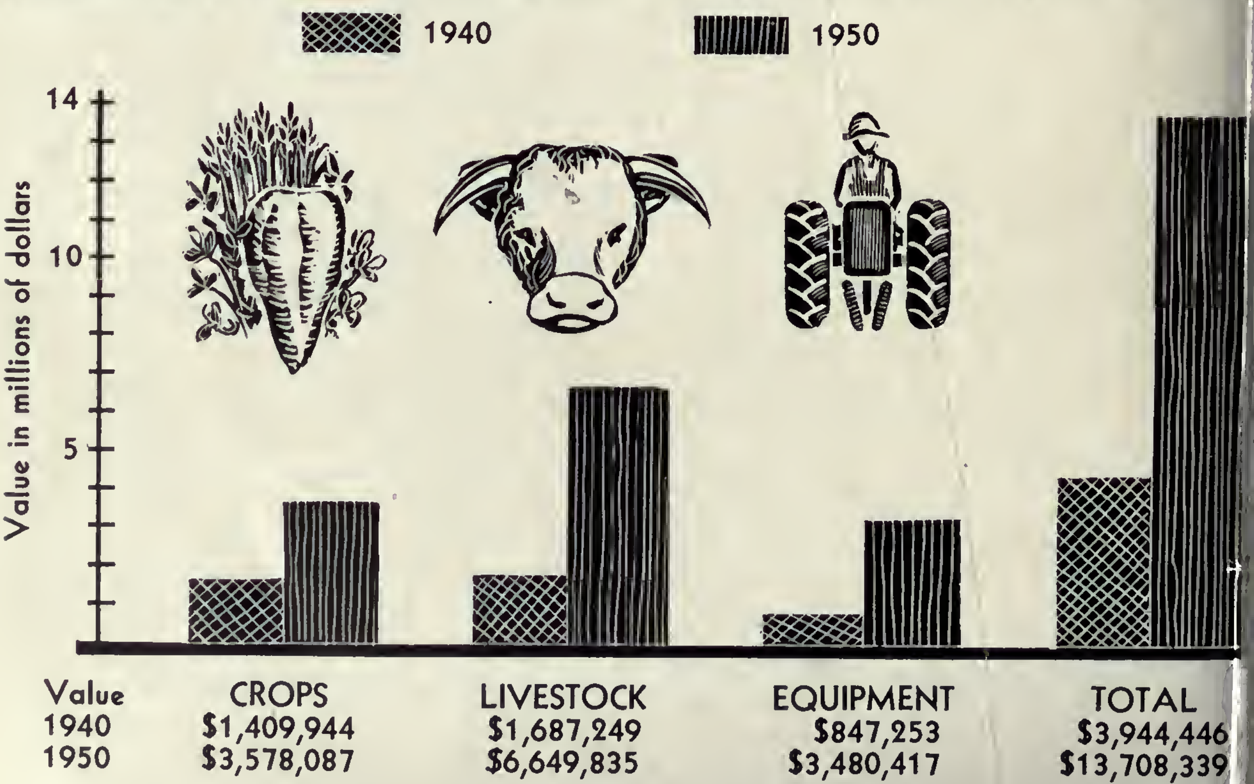
canal into the North Fork of the Milk River, and according to a treaty between the United States and Great Britain, signed in 1909, the water of the combined rivers is divided between the two countries with Canada receiving approximately 370,000 acre-feet during recent years and the United States about 290.000 acre-feet. Safe passage is guaranteed for United State's water in the Milk River channel as it journeys through Alberta. By this arrangement with Canada, which has vast reserves of irrigation water (over 4,000,000 acre-feet in Alberta alone), it has been possible to convey about 260,000 acre-feet of western Montana water through Canada for use on eastern Montana lands during recent years. Although it would have been possible to build a canal entirely within the United States, which might have served this purpose, Canada and the United States jointly saw the wisdom of measures to convey the United States portion of the waters via the existing Milk River channel through Canada.

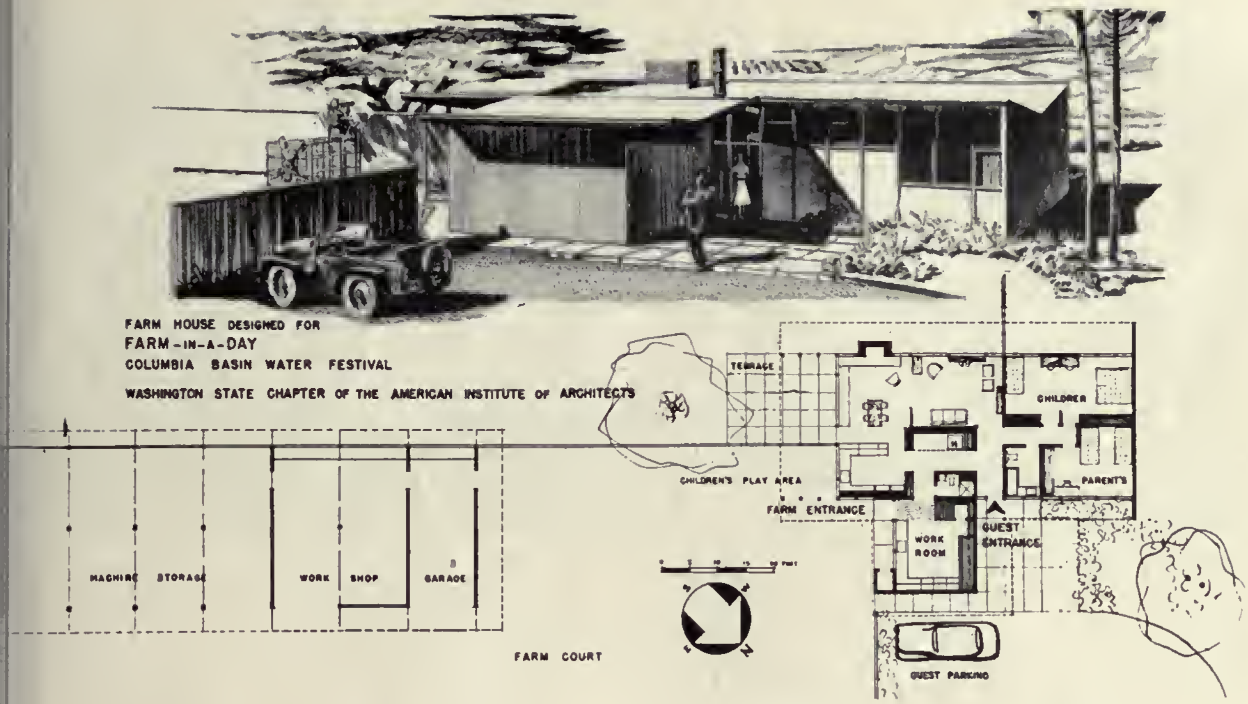
Irrigation from Milk River began around 1890 when an experienced irrigation farmer named T. B. Burns, along with some other settlers, built a brush and rock dam near the present site of th Fort Belknap diversion dam at the Agency Cana in what is now known as the Chinook Division o the Milk River project. But the Milk River named by Captain James Merriwether for th color of its silt-laden water during each untimel flood, was and is an erratic stream. Some year there would be more than enough rainfall to grow dry-land crops, and plenty of water to flood an irrigate fields—mostly winter feed for livestock— and the farmer-ranchers built up their herds an prospered. At other times, the Milk River ra thin, and rainfall was scarce. During those year the settlers and their livestock faced hard times and looked around for a more dependable sourc of irrigation water.

Early surveys by the United States Geologica Survey in 1891 and the United States Reclama tion Service in 1902, paved the way for the Mill River reclamation project and construction bega in 1906. Water for the irrigation of Milk Rive lands from the diversion works and canals on th project itself was first delivered in 1911. Th remote canal to carry St. Mary water to the Nort

(Please turn to page 120)

BY COMBINING IRRIGATION FARMING AND LIVESTOCK PRODUCTION MILK RIVER OPERATORS CAN AND DO INCREASE EQUIPMENT VALU





FARM HOUSE DESIGNED FOR
FARM-IN-A-DAY
COLUMBIA BASIN WATER FESTIVAL
WASHINGTON STATE CHAPTER OF THE AMERICAN INSTITUTE OF ARCHITECTS

Design for MODERN FARM LIVING

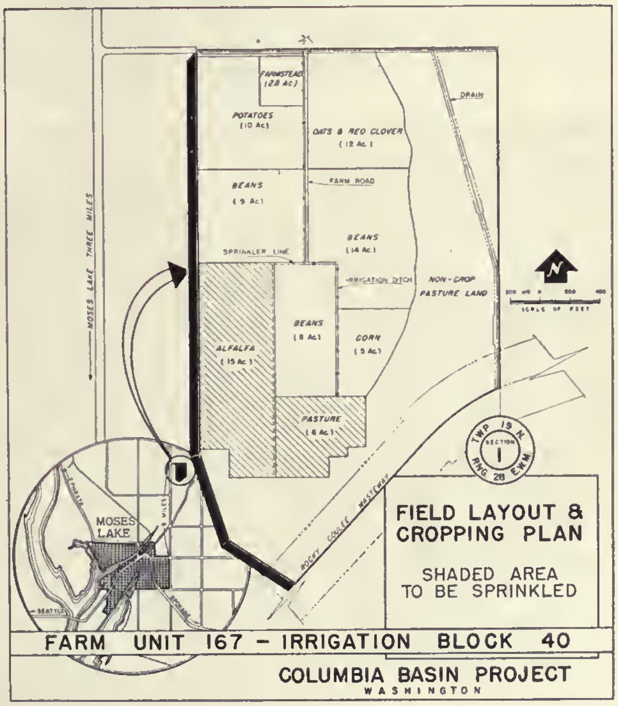
On Thursday, May 29, 1952, on the Columbia Basin Project in Washington, Donald D. Dunn will be $50,000 richer and many spectators will see a rare demonstration difficult to evaluate in dollars and cents, but worth time and money to home owners, and farmers anywhere.

This will be the highlight of the Columbia Basin Water Festival from May 22 to June 1st, when the people of the State of Washington celebrate the completion of irrigation works to supply water to 87,000 Columbia Basin farms. (See last month's special Columbia Basin issue.)

A Nation-wide search was made by the Veterans of Foreign Wars for the most worthy qualified veteran to receive the farm which will be transformed from raw, sagebrush covered land into a going 80-acre farm, complete with the latest in farm homes, buildings, furnishings and facilities, all within a 24-hour period. Dunn won.

This prize along with the eleven-day celebration was made possible through the cooperation

(Please turn to page 112)



FIELD LAYOUT & CROPPING PLAN

SHADED AREA TO BE SPRINKLED

FARM UNIT 167 – IRRIGATION BLOCK 40

COLUMBIA BASIN PROJECT
WASHINGTON

ADDRESSING OPERATION AND MAINTENANCE CONFERENCE of the Bureau of Reclamation in Washington, D. C., Representative Clair Engle stresses need for close cooperation with State and local organizations. At extreme left, in profile, Floyd Dominy, Assistant O & M Director; at Engle's right, O & M Director E. D. Eaton; Engle is standing addressing the group, and at extreme right is Assistant O & M Director Hollis Sanford. Photo by Glenn Peart, Interior Department photographer.

FORMULA FOR FEDERAL-STATE COOPERATION on Water Resource Development

by the Honorable CLAIR ENGLE, Representative from California

Chairman of the Subcommittee on Irrigation and Reclamation of the Committee on Interior and Insular Affairs of the House of Representatives

MOST PEOPLE DO NOT REALIZE that in a few years we may face a food shortage.

The rapid increase in our population requires that our land and water development keep pace with the growing demands of our population. That does not take into consideration whatever strains may be put on our agricultural economy in the next decade or the one thereafter by international emergencies such as we have encountered since the start of the Korean war. And even though we could keep pace without too much difficulty with the growing demands of our population and the rising standard of living in this country, irrigated farm lands throughout the Nation are a bulwark against the ravages of drought, dust storms, and floods which sweep away our land resources.

Incidental to water development usually is the development of hydroelectric power. Such has been the history in the far West. Today electrical power is critically short in every area of the Nation, and our reserves are insufficient in view of our anticipated power needs.

Through a water resource development program, we can meet the necessary food requirements of our growing population, stabilize our agriculture and add to the short power reserve all in one program. There is no question that these things need to be done, and in one way or another will be done.

Most of the easy water and land development projects have been built. As far as I know there are very few States in the far West that have the financial resources to build the huge water and power projects that are now necessary. Moreover, there is a recognized necessity of planning for river basin development as a whole, instead of having a patchwork of plans by separate agencies for separate purposes. There should be one plan for one river or one system of rivers, even though it involves a number of States. That is the only way of assuring the most harmonious development of the water resources of a basin from an engineering or any other viewpoint.

It is a well-known axiom that Federal juris-[...]tion follows the Federal dollar. If the Fed-[...]l Government is permitted to continue to carry [...] whole financial burden of water development [...]ograms in this country, Federal jurisdiction will [...]evitably follow.

The first step toward solving the problem of [...]eventing the complete Federalization of the [...]ter resources development program in this [...]untry is to get some "State dollars" into the [...]ter development program—and this should [...]rt right with the planning stages of a project. [...]hereupon, State jurisdiction will start following [...]e State dollars.

Heretofore the reimbursement to the Federal [...]overnment for the costs of water development [...]ojects, particularly Reclamation projects, has [...]en based upon the direct beneficiaries—the [...]tual water and power users—repaying the reim-[...]rsable costs. All of the indirect benefits [...]flected in an improved and enlarged tax base, [...]gher assessed valuations, increasing prosperity, [...]tter soil conservation, reduced flood damage, [...]proved navigation and the development of fish [...]d wild life and all other benefits have been [...]sorbed by the Federal Government. In short, [...]e States receive benefits from these projects [...]hich can and should, in part at least, be paid for. [...]ere is a proper field for local and State contribu-[...]on which will not only lessen the burden on the [...]ederal Government but will provide for the pay-[...]ent of benefits where benefits are received.

The second step is that the Federal Government [...]hould be required to recognize the supremacy [...]f State law in the allocation of water rights and [...]ater uses. The controlling effect of State law [...]ver the water resources of a State has been recog-[...]ized time and again in Federal statutes and has [...]een asserted without dispute by the Congress of [...]he United Statees on innumerable occasions. As [...] corollary of that basic proposition, it has been [...]dmitted that in the construction of a Reclamation [...]roject the Federal Government is merely a car-[...]ier and does not acquire title to the water which [...]elongs to the people of the State, and does not [...]cquire any jurisdiction over the distribution of [...]hat natural resource beyond that which is inher-[...]nt in the project operation itself.

It may seem strange that in the light of the [...]recedents in this field that question should have [...]een put in issue as recently as in the Santa Mar-[...]garita case in Southern California.

In the last 20 years during which we have seen a tremendous growth of Federal Government, many people have lost sight of the fact that under our constitution the Federal Government only has those powers specifically delegated to it in the constitution and such as may be reasonably implied from those granted. All other powers are reserved to the States or the people. The power to regulate commerce, for instance, does not give the Federal Government title to the water in the navigable streams of this country. Nor does the building of a dam give the Federal Government title to the water caught behind the dam.

The third step is to set up a Federal-State liaison which will insure effective State participation from the beginning in the planning and execution of water development projects.

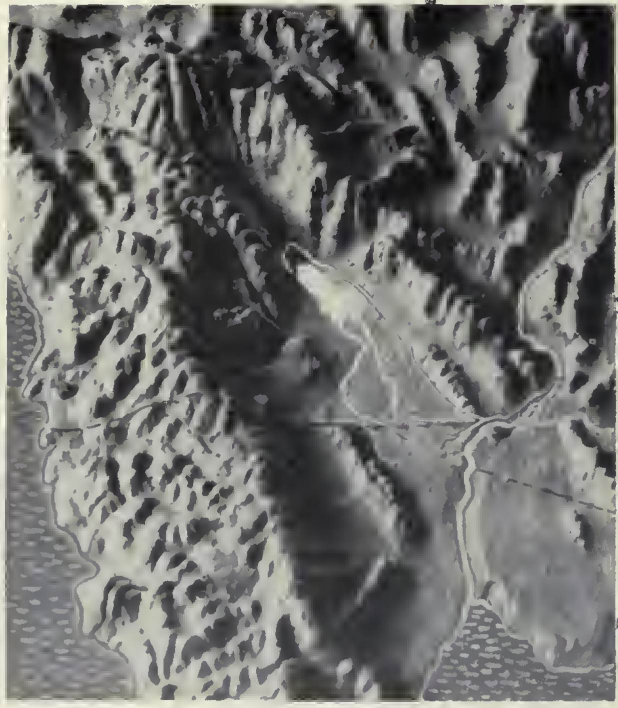
On this point I have in mind a formal organization consisting of the representatives of Federal and State agencies charged with the responsibility for water development. The Federal Government has already set up inter-agency committees on a voluntary basis in the Missouri, Columbia, and Colorado Basins. Provision has been made for participation of the basin States in the Missouri and Columbia basin committees. This is a start in the right direction, and must be followed up vigorously by the States.

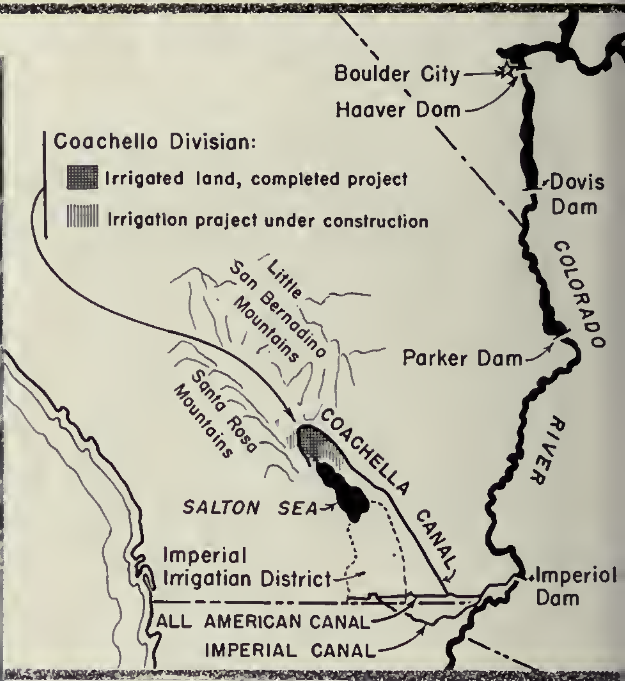
The National Reclamation Association has held meetings with representatives of the Bureau of the Budget in an effort to arrive at an understanding of the relative voting power of the State and the Federal agencies in just such an organization.

This last is the mechanical or functional step to give real meaning to the first two steps I have suggested. It provides for the method of operation, the means of protecting the State investment in the water project, and the machinery for bringing to bear the controlling force of State law in the distribution and use of water.

If these three steps are taken, the planning and building of future large water and land development projects can go forward cooperatively and with a maximum of efficiency. Our objective should be to retain the benefits of necessary Federal participation without losing the benefits of local administration and control. # # #

An adaptation of Congressman Engle's address during the thirty-third annual meeting of the American Farm Bureau Federation at the Stevens Hotel in Chicago, Ill., December 11, 1951.





BELOW SEA LEVEL lies the Salton Sink, represented in the re map at left, the white blob being the Salton Sea. Ab Coachella's relationship to the Boulder Canyon project.

THE COACHELLA DRAINAG

Part 1—Forewarned Is Forearmed

In California's Coachella Valley, the people are doing something about drainage before drainage difficulties do something to them.

They have sentries posted to give them warnings of dangerous underground water movements. They have a crew of technicians ready to plot the best means of foiling any dangerous uprising, and they have new machines, laboratory equipment and engineering devices available to save the valuable lands of the Coachella Valley from the insidious invasions of the elusive underground water.

Four agencies work together to perform these unique tasks, which all come under the title of the Coachella Valley Cooperative Drainage Investigations. The Coachella Valley County Water District, the Department of Agriculture's United States Salinity Laboratory at Riverside, Calif., and the University of California, through its Division of Irrigation and Soils at Los Angeles, and the Bureau of Reclamation, are the primary forces behind this work.

If this sounds like an elaborately precaution program, just remember the fall of Babylon a the passing of the Ho-Ho-Kam. According archeologists and historians, these once-flouri ing irrigated areas were abandoned because waterlogging and seepage, due to inadequ drainage. Proving that history repeats its the Bureau of the Census reports that over 2 million acres of crops were spoiled or complet lost in the United States in 1950 due to fai poor drainage—and this is only the prelimin figure relating to acreages of 500 or more.

People in the Coachella Valley have taken t ancient and modern lessons to heart. This va is an American version of the "Land of the A bian Nights," one of the most highly develo agricultural areas in the United States. In 1 the total value of crops grown on 31,000 irrig acres amounted to $13,437,977. The average g value per acre was $434. Here the farmers duce ninety percent of the Nation's domestic supply. This crop was valued at about $586 acre in 1950.

Land values are high. Vineyards, c

A WEALTHY OASIS, Coachella Valley. *Maps on the opposite page by the Washington, D. C., Graphics Section. Photos above and at right by Harry W. Myers, former Region 3 photographer.*

INVESTIGATIONS

by J. S. REGER, Hydraulic Engineer, Coachella Division, All-American Canal System, Coachella, Calif., Region 3 (Headquarters at Boulder City, Nev.)

groves, and date gardens sell for as much as $2,000 to $3,000 per acre. People are willing to pay $100 to $300 an acre for undeveloped desert land, even though they may have to invest at least $200 an acre just to level it, and much more to get it under cultivation. But they know they will get their money back when the lands produce.

In addition to the agricultural wealth of the Valley, it is one of the most highly developed winter recreational areas in the world. It is an inland valley of unsurpassed desert beauty, located between the Little San Bernadino Mountains on the east and the Santa Rosa Mountains on the west. At the lower end of the Valley, about 238 feet below sea level, lies the home of the Salton Sea Regatta, the Salton Sea, filled in its present form when the Colorado River broke through levees in 1905–6. Palm Springs, internationally known winter resort, is located near the upper end of the Valley. These recreational developments put an even higher value on the lands of the Valley.

No wonder the people of Coachella are willing to take every precautionary measure possible to prevent these lands from becoming damaged or completely ruined because of inadequate drainage.

The problem today is different than it was about 20 years ago. Then the farmers in the Coachella Valley were entirely dependent upon the ground water resources to supply their irrigation water requirements. Like Babylon and Ho-Ho-Kam, history began repeating itself. Year after year, more and more farmers mined the underground source of supply. As additional acres went under irrigation, farmers went deeper and deeper to tap the water supply. Some wells failed altogether; many had to be deepened periodically, and in a few areas the cost of sinking additional and deeper wells was more than the farmers would regain through crop production.

Farmers abandoned hope of developing large acreages of raw land. Their only hope was to find enough water for the crops under cultivation.

Then in 1928 the Boulder Canyon Project Act was passed, authorizing the construction of the

INVESTIGATORS OF THE UNDERGROUND during a field conference of an annual meeting conducted by the United States Salinity Laboratory. From left to right, J. H. Snyder, former General Manager-Chief Engineer, Coachella Valley County Water District; Dr. C. E. Kellogg, Chief of the Soil Survey Division, United States Department of Agriculture; J. S. Reger, resident engineer for the Coachella Valley Cooperative Drainage Investigations, and Dr. H. E. Hayward, Director of the United States Salinity Laboratory. *Photo courtesy of the Indio-Date Palm Newspaper.*

Coachella Branch of the All-American Canal, to carry Colorado River water into the Coachella Valley. The Bureau of Reclamation started constructing the Coachella Branch of the canal on August 11, 1938, completing it 10 years later. Work is now proceeding on the buried concrete pipe lines to carry water from the canal to 74,800 acres of Coachella Valley land.

As the Coachella people saw the new water highway take shape in the desert, they realized that they had a new problem to face. What would happen to their lands when the new water supply came surging through the pipes and was turned onto their fields? They knew about capillary action and what happens when surface water meets ground water. They had already had some experience with waterlogging and salty soil as a result of ground water rising too close to the surface.

The first thing to do, they reasoned, was to investigate the underground—find out how much water was underground, where the water was, whether it was rising, sinking, or remaining at a constant level, whether it contained salts, whether it fluctuated seasonally (if so, how much), and where additional water would come from. In 1945, before the canal was finished, the people organized the Coachella Valley Cooperative Drainage Investigations to answer these questions.

According to the four-way agreement, the Coachella Valley County Water District supplies field and office forces—well drilling crews, well readers, record keepers, draftsmen, as well as most of the drill rigs, well pipes, and other equipment and supplies needed for the field work. All groundwater observations are made and recorded by Water District employees. The Department of Agriculture's United States Salinity Laboratory at Riverside, Calif., and the University of California's Division of Irrigation and Soils at Los Angeles, Calif., furnish staff and laboratory facilities as needed and some equipment as available for analyzing well cores, samples of soil strata, water samples, and performing other tasks pertaining to the investigations. The Bureau of Reclamation maintains a drainage engineer at Coachella who devotes a major portion of his time to the investigations.

Representatives of these agencies meet at periodic intervals to study the progress, review data, and consider future phases of the investigation. This group is known as the cooperator's committee. A smaller group consisting of one member from each of the four agencies, and known as the technical committee, meets quite often to actually study minute technical details. Finally, because of the interest which has been shown in the investigations, there is a group, known as the advisory committee, which meets on the average of once each year. This committee includes, in addition to representatives of the previously mentioned agencies, representatives of the Federal Land Bank, the Bureau of Indian Affairs, and others. While not active participants in the investigation, these agencies have a real interest in the future of the undertaking. As a result of this free exchange of ideas, the investigation represents the coordinated thinking of a group of trained and experienced men, pooling their knowledge and efforts to prevent a serious drainage problem from becoming a reality.

The purpose of this four-way investigating committee is to detect and correct adverse drainage conditions before the lands involved become seriously damaged. They also are finding new and economical methods for investigating and correcting drainage problems. The people of Coachella will be ready with the answers before the questions become serious—questions like, "How much of your crop did you lose? How much of your land is ruined? You mean it's too late to do anything about it?"

(Next Month—Investigating the Underground)

BEATING THE PURPLE SAGE

O. L. KIME, Project Engineer, North Side Pumping Division, Minidoka Project, Burley, Idaho, Region 1 (headquarters at Boise, Idaho)

EDITOR'S NOTE: The December 1947 issue of the RECLAMATION ERA carried an article entitled "Australian Sagebusting Plow" which described a novel type of plow with disks mounted on individual spring-controlled arms, which permitted the disks to ride over rocks and thus reduce breakage. Following the preliminary tests reported in the Era, this sagebusting plow was modified slightly and found its way into widespread use by the Forest Service in breaking down the brush sufficiently to permit seeding on the broad ranges of Wyoming, Utah, Nevada, and elsewhere across the Nation. Particularly adapted to widespread plowing operations such as range clearing, the Australian-designed plow is not reported here in author Kime's article dealing with methods of cleaning sagebrush from irrigation farmland.

FROM TIME IMMEMORIAL, SAGEBRUSH has stood as challenge to the pioneer farmer in the West. This woody shrub was dramatized by Zane Grey "Purple Sage," was rhymed by poets as "wormood" and scientists call it *Artemisia*. There are veral species in the West but one of the most idspread is big sagebrush, *Artemisia tridentata*, -called because of the three teeth at the end of each leaf. While sagebrush is aromatic and resembles the true sage in odor, it is not the sage raised for seasoning which is really a *salvia*. Coyotes, jack rabbits, and sage ticks thrive in sagebrush. It has prevented soil erosion, has been used for livestock shelters or windbreaks, is sometimes browsed by sheep but otherwise has no value, commercial or otherwise. On the western foothills and plains it normally reaches a height of from one to three feet. In exceptionally fertile soil, and with proper amounts of moisture, it will grow to a height of 8 feet, and until recently, no marked strides have been made in methods to exterminate it.

AILING" AND PLOWING superseded rubbing" as illustrated in the sketch ove. At right, the early and tedious ethod of dragging a heavy rail or log ross the land to clear off sagebrush. low, the wheatland plow, a method hich came into favor in the 1940's. The achine can clear a swath 30 feet wide rough the pesky brush. ***Drawing by oyd Chellman, Graphics Section, Washgton, D. C.; photo at right by O. L. Kime, d photo below by Stan Rasmussen, gion 1 photographer.***

RAY SHERWOOD'S BRUSH CLEARER.—At left, the thin sharp blades which slice the brush off 2 or 4 inches below the ground. Below, the special rake, also designed by Sherwood, which does a good job of windrowing the sagebrush. *Both photos by O. L. Kime.*

Perhaps the reason why the farm machinery industry has neglected to develop a machine for clearing sagebrush is that it is not a continuous seasonal operation. Once the brush is removed and crops are started, the brush never reappears. But those who have had to contend with it, and who are now facing the problem of clearing a rugged growth of sagebrush, recognize it as a menace to western irrigation development.

The early pioneer used a grub hoe. A good day's work was a quarter acre by the dinner bell, an additional one-quarter by sundown, a cramped back, sore muscles, and a huge peeve against sage—purple or otherwise.

Next came "railing." Two spans of horses or mules dragged a heavy rail (sometimes unknowingly furnished, without due compensation, by the Union Pacific Railroad Co.) back and forth across the brush-covered ground in an attempt to wear out the sage. After each trip much of the brush would remain standing, and it was always a toss-up as to which would wear out first, the horses, the mules, the man, or the brush. This method was favored, or rather accepted, in the West for possibly a period of 60 or 70 years, the only marked change being the substitution of a tractor for the horses or mules.

The first real improvement was made by welding two of the rails into a "V" shape, with cutting blades attached along the outside of the rails. Another rail was extended along the bisector of the angle thus formed, and a rudder was installed to hold the machine in a straight line behind the drawbar. Other cross pieces were provided to strengthen the equipment. Although this equipment required more drawbar horsepower and moved too much soil into windrows with the brush it was an improvement.

In grubbing or railing, the loosened or uprooted brush would be raked, bunched and burned. With the V-shaped sage cutter, the brush was pulled from the windrows of soil and burned, after which the soil had to be levelled back in place.

In the 1940's the wheatland plow came into favor. This required a large amount of drawba

"BEATING" THE SAGE with a machine originally designed for be[et] topping or tilling the soil. The dogged little machine chops awa[y] of the sagebrush. *Photo by O. L. Kime.*

power, usually powered by tractors of the crawler type with 35-horsepower and over. Disc plows arranged side by side can clear a swath 30 feet wide when drawn by a 113-horsepower caterpillar tractor. The brush is usually raked with a modified morrell rake in which the spokes of the rotating wheels are covered with a shield of tin. This moves the brush to the side and keeps it from becoming entangled in the spokes. Brush cleared by this method in 1949 cost $6.75 per acre—$2.50 for plowing and $4.25 for raking and burning.

A commercial cultivator with a V-shaped blade suspended from a heavy frame supported by two wheels can also be used for clearing sagebrush. The blade is set to penetrate the ground at a given depth by use of a hydraulic mechanism, and slashes the brush 3 to 6 inches below the ground surface. Although this process is successful, we have not used it widely on our project, possibly because the machine requires a high powered tractor, and also represents a considerable initial expense for equipment that can only be used for one purpose.

Ray Sherwood of Twin Falls, Idaho has designed a machine along the same lines as the cultivator with thin sharp blades for cutting the sagebrush off 2 or 4 inches under the ground. Two or three cutting blades can be drawn side by side with one tractor. With two tractors and two operators, Mr. Sherwood is able to cut 80 acres in an 8-hour day. The machine has an improved rake which does an excellent job of windrowing, and removes 90 to 98 percent of the brush. Its only drawback is that it will not work in rocky ground. Mr. Sherwood also improvised a "flame-thrower" and burns the brush by traveling in a moving truck at 5 to 8 miles per hour and spraying an ignited stream of kerosene on the rows of sagebrush. Burning is very complete and is accelerated if there is some wind. Mr. Sherwood's price for clearing and burning was $9 per acre in 1951.

North Side Pumping Division farmers exterminated 1,600 acres of sagebrush by beating it with a little machine made principally for jobs like soil tillage, or sugar beet topping. This machine has a rotating shaft that turns at about 1,800 revolutions per minute, to which are connected a large number of beating arms, pivoted where connected to allow a given amount of flexibility. The business-end of the arm has two rugged fingers, or side projections, making a formidable weapon or chopper.

The rotor shaft is turned by take-off power from the ordinary farm tractor to which the machine is attached. The little machine wades into the brush, twice as high as itself, and leaves a sickly stand of brush stubs behind it. A second trip will nearly finish it off to the ground surface. The "exhaust" from the machine is a cyclone of dust and brush fragments. The brush fragments resemble hogged fuel, but are not as fine as sawdust. This residue is scattered fairly even over the surface of the ground, and plowing turns it under. We found that the wood pulp would add to the humus of the soil, but requires heavier applications of nitrate fertilizer to break down the cellulose structure. The roots and stumps are somewhat of a hazard as they are not all covered by plowing. However, their existence did not seem to interfere extensively with subsequent farm operations. The present commerical machine should be made heavier and sturdier for sagebrush operations as some of the bearings and beater arms couldn't take the punishment. The machine works better in rocks than other clearing machines, but rocks should be avoided if possible.

All the methods of clearing give satisfactory results in planting and irrigating farms—depending, of course, on the individual who does the clearing. Two farmers using the same method and same machinery will not always produce the same results. In some cases sagebrush clogged corrugations, making irrigation less efficient the first time water was run through. After the first irrigation, very little trouble was encountered from the sagebrush until harvesting time. Farmers who were digging potatoes often had to stop and clean brush off the digger points, where brush left behind in the field had built up in front of the machine. The sagebrush had made its last defiant stand. # # #

NEXT MONTH

Reclamation's Golden Jubilee

Featuring the highlights of 50 years of progress by water users in the 17 Western States where reclaimed lands have been adding to the Nation's wealth since the Reclamation Act was passed on June 17, 1902.

In the June 1952 issue of the *Reclamation Era* and subsequent issues during Reclamation's Golden Jubilee Year, we will chart the progress made during the past half century in the varied and diversified activities connected with conserving and using water made available through the facilities of the Bureau of Reclamation, and the contribution to the Nation's welfare made by past and present pioneers, now represented by the third of a million settlers living in the Reclamation area.

Design for Modern Farm Living

(Continued from page 103)

of many organizations and individuals in the State of Washington who have contributed time, money and effort to commemorate the beginning of an irrigation area larger than Rhode Island, which will eventually total 1,000,000 acres, with about 13,000 farms.

A committee of five leading architects from the Washington Chapter, American Institute of Architects, designed the home, in association with the Extension Service of Washington State College.

Complete working drawings and specifications will be made available through county agents, the Extension Service and the Farmers' Home Administration, to prospective settlers of this million-acre project.

The Western Retail Lumbermen's Association of Seattle, working with its suppliers, other manufacturing and business interests, the Merchants of Moses Lake, and labor unions, will donate all the materials and build the Farm-in-a-day buildings. Cost of the house is estimated at $19,000 and the value of the completed farm is placed at $50,000.

# # #

May 20 Deadline for Yuma Mesa Farms

According to the Bureau's Yuma, Ariz., office the article in the December 1951 issue of the RECLAMATION ERA regarding the public land opening on the Yuma Mesa of 27 new farm units brought a terrific response. An estimated 800 letters made direct reference to that article

May 20 is the last day for veterans of World Wars I and II, the Spanish American War, and the Philippine Insurrection to file their applications for these farms. This is the second public land opening on the Yuma Mesa. Application blanks and information may be obtained from the District Manager, Lower Colorado River District, Bureau of Reclamation, Yuma, Ariz., or Regional Director, Bureau of Reclamation, Boulder City, Nev.

The public announcement states that the 27 farms embrace an area of 4,030 acres and range in size from 113 to 160 acres. Our article in the December ERA which contained preliminary figures showed a total of 4,051 acres with farms ranging from 116 to 160 acres. •

Last Call for Columbia Basin Farms in 195

May 16 is the final day applications may be file for the purchase of 32 farm units in the Frankli County area of the Columbia Basin project i the State of Washington. Veterans of Worl War II will have first preference in filing ap plications for the farms. All inquiries shoul be addressed to the Bureau of Reclamatio Ephrata, Wash.

The 32 farms vary in size from 48 to 153 irr gable acres and will sell for prices ranging fro $1,091 to $7,298. Veterans and others applyin for the farms must have had at least 2 years ful time farm experience after reaching the age 15 and have assets of $4,500.

This is the final sale of Columbia Basin farn to be offered this year. A land drawing will l held at Othello, Wash., on May 31. •

New Wildlife Refuge in Arizona

Arizona's Game and Fish Commission, and t Department of Interior's Fish and Wildlife Ser ice and Bureau of Reclamation, have work out an agreement whereby hunters and fisherm in Arizona will benefit from the development a new 5,000-acre resting and feeding ground f waterfowl at Mittry Lake, near Yuma. Ariz.

Mittry Lake is a body of water isolated fr the Colorado River in back of the Bureau Reclamation's Laguna Dam, and within the res voir site. The Federal Government has lea 8 sections of this public land to the State Co mission which at its own expense will constr inlet and outlet facilities for Mittry Lake to per fresh Colorado River water to flow through now stagnant lake and thus promote the gro of waterfowl food and permit the propaga of game fish in the area.

The agreement provides for the nonconsump flow of not more than 10 cubic feet of water second to the lake from the Colorado River. State Commission has agreed that the location plans for the inlet and outlet structures be proved by the Bureau of Reclamation.

In approving the agreement for the Depart of the Interior, Acting Secretary of the Inte Richard D. Searles stated that this was a stri example of the Federal policy for full recogn of recreational values in the development o water resource conservation program in the W ern States. •

ROUNDING UP THE RIO

TO KEEP THE RIVER IN BOUNDS new channels are being excavated. Above, a 6-yard dragline cuts a wide swath, followed by a 3-yard machine. *All photos for this article by Fred Finch, Region 5 photographer.*

by GARFORD L. WILKINSON,
Region 5 Headquarters
Amarillo, Tex.

There's a big round-up down in New Mexico.

A river—the Rio Grande—has been ranging too wide, too high and far from handsome, and a crew of top hands headed by John C. Thompson, Bureau of Reclamation Project Engineer, in Albuquerque, equipped with modern instruments supplied by McGinnes Brothers' Contracting Co. of Houston, Tex. are building corrals and "river guards" to keep it within bounds.

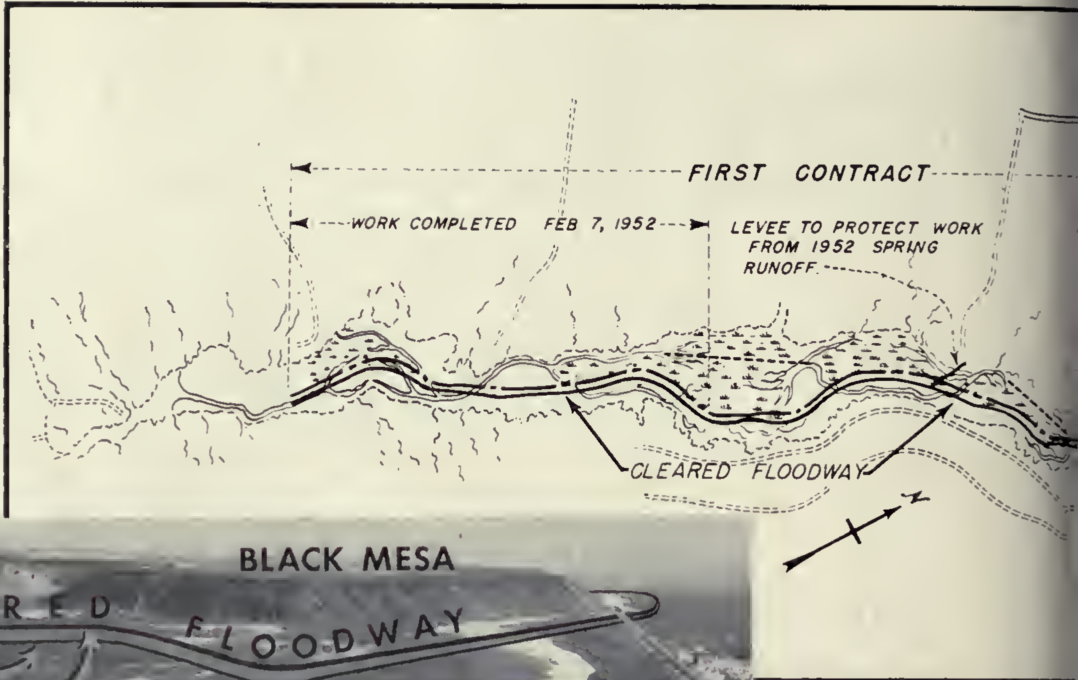
The white man's coming has resulted in many changes in the Rio Grande basin. The river, extending 1800 miles from the shadow of the great divide in Colorado to its mouth in the Gulf of Mexico, was and is a clear flowing stream in the mountain areas that are the source of most of its water. Below the mountains the river passes through many miles of desert area. Originally this area, with low and somewhat ephemeral run-off, contributed some sediment to the main stream. Today, with increased use of the basin lands for grazing and agriculture, run-off from the desert area has probably increased slightly, but the sediment dumped into the Rio Grande has increased a great deal. This, coupled with increased diversions of water in the mountain areas, has resulted in raising the bed of the Rio Grande until now it is higher than downtown Albuquerque, largest city in the State.

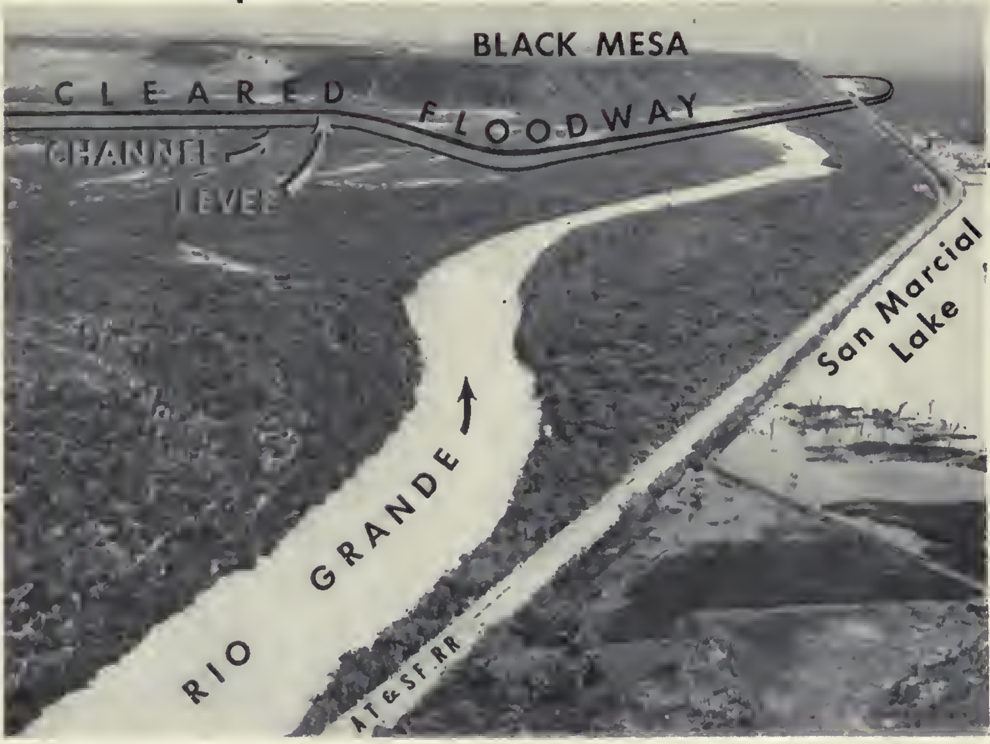
And when the old river runs out of bounds, it can be tremendously harmful to all who live near it.

Back in 1929, for example, swirling, muddy waters swept through the town of San Marcial, approximately 100 miles below Albuquerque. Today, San Marcial lies buried in sand and mud; its former inhabitants striving for new homes elsewhere.

The river serves three States and the Republic of Mexico. The round-up, or channelization work, is being conducted in New Mexico's vast Middle Rio Grande Valley, where the river is the major source of water, affecting the welfare of persons far downstream who irrigate the 156,000-acre Rio Grande project in Southeastern New Mexico and West Texas (in the vicinity of El Paso) as well as those in the Middle Valley's 80,000 cultivated acres, including about 20,000 acres tilled by Indians.

Twenty-seven years ago landowners in the Middle Valley organized a conservancy district to provide private financing for the construction of extensive river improvement works, including a storage dam on the Rio Chama, a tributary of the Rio Grande. The Rio Chama rises about 10 miles north of the Colorado-New Mexico line and its waters are stored in El Vado Reservoir in New





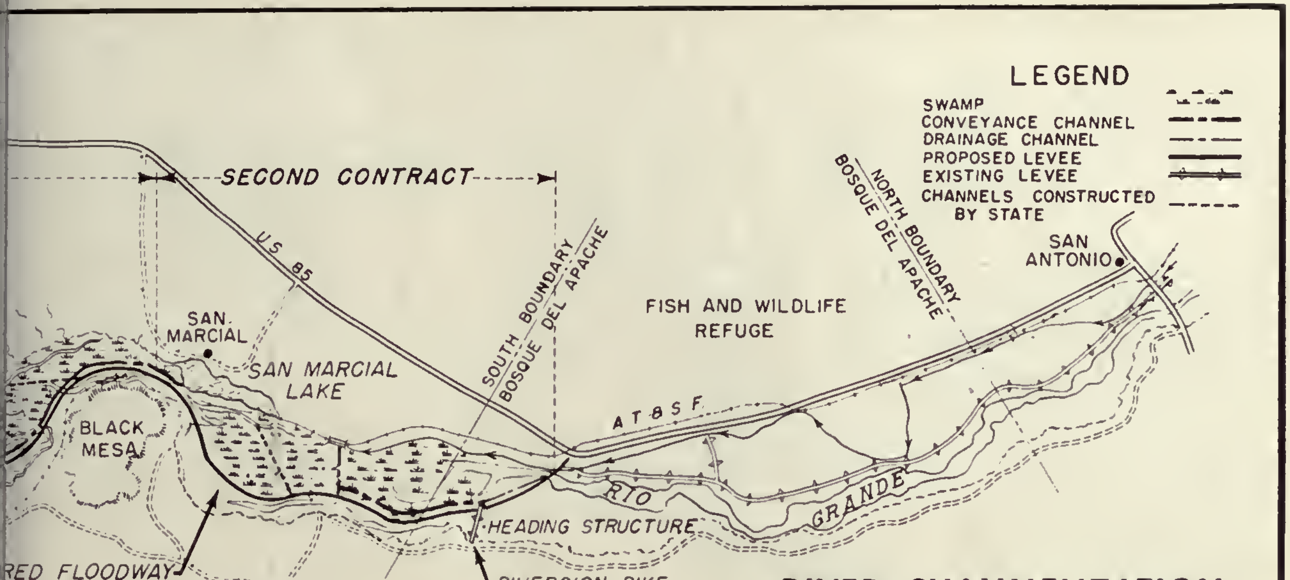
REROUTING THE RIO—The channel for the Rio Grande, dug through the 30-mile-long swamp, is shown above, as line. A levee (solid black lin the channel and mesa will for way" or "paddock" for the runs wild and washes out th dike on the right side of the the left of old Fort Craig is sho temporary levee and emergen to take care of spring run-of The four emergency ditches du mer and fall by the State servancy District are also show dashed lines. At left, an ae the 2-mile-wide river flood pla the inundated town of S flooded in 1929. Map abo by Region 5, at right by Grap Washington, D. C.

Mexico. El Vado Dam was completed in 1935.

But the Middle Rio Grande Conservancy District's attempt to remedy the multiplying evils of the river were unsuccessful. Sediment raised the river bed and the under-ground water level. Additional farm lands were waterlogged and made unproductive. Vast swamps, infested with forest-like growths of salt cedars (tamarisk), appeared in the vicinity of old San Marcial. It is estimated that more than 140,000 acre-feet of water a year are consumed by useless vegetation in this one area alone. This large loss of precious water, charged under the Rio Grande Compact to the Middle Valley, contributes much to the continuing debt of water owed to downstream irrigators.

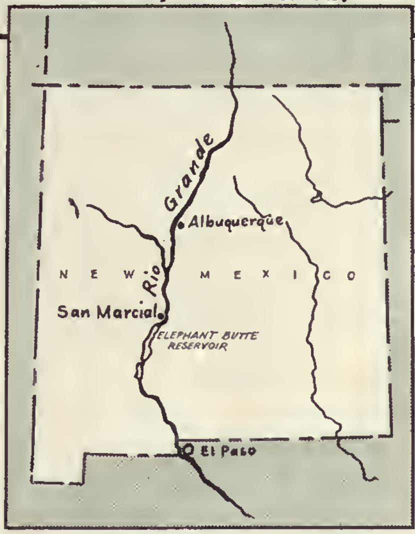
Faced with these major problems local officials and civic leaders, including the Middle Rio Grande Conservancy District, called in Federal agencies to look over the situation and design an operating plan that would restore the stream to its former usefulness.

Legislation authorizing the appropriation of funds for a joint program of irrigation, drainage, flood and sediment control by the Bureau of Recla-



RIVER CHANNELIZATION

Vicinity San Marcial



mation and the Army Corps of Engineers was signed by the President in 1950. Award of a construction contract for channelization of a 21-mile stretch of the Rio Grande above Elephant Butte Reservoir, the Rio Grande project's storage reservoir near Truth or Consequences, N. Mex., and execution of an agreement by water users in the Middle Rio Grande Conservancy District to repay the Federal Government for the repair and extension of the irrigation and drainage system of the district, was approved in September 1951 by Secretary of the Interior Oscar L. Chapman.

Channelization of the Rio Grande from the San Marcial swamp area to the narrows of Elephant Butte reservoir began last fall. About 21 miles of the channel will be constructed under the present million-dollar contract. The remaining 17 miles of channel will require another appropriation by Congress.

The whole 38 miles of the channel will extend from the Elephant Butte narrows through the San Marcial area northward in to the Bosque Del Apache Fish and Wildlife Refuge. Structures will be constructed to divert normal flows into the channel. A low, earthen dike, or levee, will be so constructed that whenever a head of water, too great for the channel to carry, comes rushing down the river, the dike will wash out and dump the excess water into a confined and cleared space formed by the channel levee and high ground east of the river. This 1,000-foot-wide floodway will handle flows up to 2,500 cubic feet per second during flood seasons and will protect the permanent channel.

Four emergency ditches were dug last summer and fall as a joint project of the State, the Elephant Butte Water User's Association, and the Middle Rio Grande Conservancy District. These ditches, which connect remaining sections of the old river channel, have speeded the flow of water into Elephant Butte Reservoir, and helped to drain the land in the area being channelized, thus making it possible for heavy construction machinery to operate in the area.

Last summer thousands of farmers on the Rio

"X" MARKS THE SPOT where the photo above was taken—an indication of the size of the 8 miles of State-constructed channels for the Rio Grande, representing $100,000 worth of State money. Last December the river was 6 inches deep in this area—too shallow for a boat, and too deep for wading.

Grande project faced imminent disaster. Their reservoirs, below the Middle Rio Grande area, were virtually dry and their fields, which in the previous year produced crops valued at more than $40 million, faced ruin. Although one of the worst droughts in the record history of the Rio Grande's watershed was the primary cause of the project's tragic shortage of water, the huge quantities of water that were being wasted in the Middle Valley's swamp area contributed greatly to the downstream problem.

In early February, water was flowing into Elephant Butte Reservoir at the rate of some 1,500 acre-feet a day—much more than at that time of the year for a number of years past. Credit for much of this flow was given to the emergency ditches dug last summer. Combined length of the ditches is about 8 miles, designed to carry about 1,000 cubic feet per second of water a day southward. Thus, the people in the Middle Valley and those farther south, on the Rio Grande project, are beginning to learn the value of the permanent channelization program now in progress.

The emergency ditches are likely to be damaged, possibly washed out, during a heavy flood. However, the permanent channel would carry safely about 2,000 cubic feet per second of water a day into Elephant Butte Reservoir. Unlike the emergency ditches, the permanent channel will be protected from floods by the cleared floodway, and its "self-operating" levee.

The round-up crew is keeping an eye on the weather.

In some areas, a record-breaking pile of snow, holding three times the normal amount of water, is piled up in the river's watershed. In its March snow report, the United States Weather Bureau said that with normal snow and rain about 1,400,000 acre-feet of water could come thundering down the Rio Grande. That would be about 130 percent of the average flow, and about three times the amount of water which flowed downstream during the preceding 12 months.

The possibility of flood depends strictly on what the weather does from now until the snow melts. Contemplated flood-control works on the Rio Grande will not be completed for several years. Meanwhile, the people in the Middle Valley, often thirsting for water, await what fate and the river have in store for them. The people, both rural and urban, have faith in the round-up, but this river is a maverick. # # #

Jamestown Dam Under Construction

During the latter part of March 1952, the C. F. Lytle Co. of Sioux City, Iowa, was awarded the $1,868,862 contract for constructing Jamestown Dam, 1 mile north of Jamestown, N. Dak., on the James River.

This earthfill dam, 1,410 feet long and 110 feet high, is part of the flood control system on the Missouri River. Irrigation facilities are to be provided in the future. Funds for starting construction were made available shortly after the disastrous floods in the region last fall.

According to the contract, work should be completed in 800 days, or approximately 2½ years. •

Work Proceeds on Coachella System

In a little more than a year now, an additional 50 miles of buried pipeline and accompanying structures for the Coachella Branch of the All-American Canal System in California will be completed, according to the terms of the $1,598,-798 contract awarded on February 14, 1952 to the R. V. Lloyd & Co. of Coachella, Calif.

The contractors will lay the precast concrete pipe, which is from 1 to 6 feet in diameter, construct collection boxes, box, pipe, bend, angle vent and meter stands and line meter wells, install gates, hoist valves, line meter tubes with meters, vent pipes and miscellaneous metal work. Turnouts are not included in the contract. •

Time and Money Saved at Folsom

With the award of a contract for the fourth large transformer for the Folsom Power Plant switchyard on the Central Valley project in California on March 11, 1952, the Bureau of Reclamation saved more than $76,000 and 6 month's time. The time and money were saved through awarding the $302,912 contract to the English Electric Co., the lowest bidder, and the only one stating that delivery of this autotransformer could be made within 730 days—the time required for gearing its installation to the kilowatt schedules submitted to Congress.

The dam and the power plant on the American River near Sacramento will, when completed, provide more than 160,000 kilowatts of vitally needed hydroelectric power capacity for domestic, municipal, industrial, and defense plant use in California. •

St. Vrain Canal Under Way

Two contractors, the Winston Bros. Co., of Monrovia, Calif., and Adler Construction Co., of Loveland, Colo., are working together on the $2,600,000 job of constructing the St. Vrain supply canal on the Colorado-Big Thompson project.

This 10-mile-long canal will run south from Carter Lake Reservoir to the St. Vrain River at Lyons, Colo., and will consist of 4 miles of unlined canal, 4 miles of concrete-lined canal, two 8.5-foot diameter horseshoe-shaped tunnels totaling $\frac{8}{10}$ths of a mile, a 1,700-foot long 8.5-foot circular siphon under the Little Thompson River, 2,400 feet of additional siphons, rectangular flume, chutes, conduits, siphon spillways, turnouts, and overchutes.

The contract, which was awarded on March 24, 1952, also includes the construction of timber bridges, and access and farm roads. Work is to be completed in about 2 years. •

Warne Speaks at Point Four Conference

William E. Warne, now Minister to Iran, formerly Assistant Secretary of the Interior, and Assistant Reclamation Commissioner, was a surprise speaker at the National Conference on International Economic and Social Development held in Washington, D. C. on April 7, 8 and 9.

Mr. Warne, who had been in Iran since November 1951, had returned briefly to the United States for business reasons, and was invited to appear before the conference during the Wednesday morning session along with Secretary of State Dean Acheson, Acting Director of the Technical Cooperation Administration Jonathan Bingham, Special Consultant to the Secretary of State Stanley Andrews, and Mutual Security Agency Assistant Director Clarence Decker.

Mr. Warne told of an Iranian area close to the Russian border, suffering from the effects of a 3-year drought, where a few hundred tons of seed and instruction in methods of seed selection and planting had resulted in a crop this year where there would have been widespread starvation.

The conference was attended by over 1,200 delegates from private industry, and both private and public national and international organizations gathered to take inventory of the Point Four program and increase its effectiveness in guaranteeing world peace and the future prosperity of the United States and the Free World.

Several references were made by prominent speakers to the importance of irrigation and power development in the Point Four program, and the success already apparent as a result of assistance like that rendered by the Bureau of Reclamation in training and making available technicians in these fields. •

AT THE CONTROLS of the outlet works of Horsetooth Dam when water was released for the first time in July 1951 are the author, J. M. Dille (at left) and South Platte River District Manager J. H. Knights of the Bureau of Reclamation. *Photo by N. T. Novitt, Region 7 photographer.*

HOW A CONSERVANCY DISTRICT WORKS

by J. M. DILLE, Secretary-Manager, Northern Colorado Water Conservancy District, Greeley, Colo.

Adapted from an address on January 17, 1952, during the Water Users Conference at which the Four States Irrigation Council was organized at the Region 7 headquarters in Denver, Colo.

Part 1—Assuring a Water Supply

FOR FORTY YEARS I have been a manager of irrigation systems in northern Colorado and for the past 13 years or more secretary-manager of Northern Colorado Water Conservancy District, the contracting agency with the United States for construction of the Colorado-Big Thompson project.

The full story of the District would start 90 years ago, when, during the gold rush period in the 1860's, the first settlers built some small ditches to irrigate bottom lands along the streams.

However, the first major undertaking and one which blazed the trail for many later cooperative efforts was the Union Colony at Greeley.

In 1870 when the Denver Pacific was building the first railroad into Colorado from Cheyenne, these eastern people under a kind of cooperative society established themselves on a tract of raw prairie and with little knowledge of irrigation or even farming, worked out many basic irrigation problems with no precedents to guide them.

The history of this Colony is a heart-warming record of courage and persistence in the face of early failures and disappointments.

Their original solutions of irrigation problems included a theory of priority of right by use, laboriously worked out in their own way, but later enacted into State Law as the basis of the Colorado doctrine.

The success of this Colony, such as it was, was widely advertised by Horace Greeley in the New York Tribune and was largely responsible for the rapid settlement of the South Platte Valley during the 1870's and 1880's when most of the irrigation systems which now serve the area were conceived and built—the real reclamation program in the region, carried on entirely by local initiative and capital.

During the 1890's when it was realized that the streams were not as inexhaustible as originally supposed, came a period of reservoir construction to conserve the occasional surplus flows.

Later, after 1900, an optimistic decade brought on the building of a number of large canal and reservoir systems financed by the organization of irrigation districts.

The final result is that there are over one hundred separate systems now serving the 700,000 acres of irrigated land included in our Conservancy District. These range from small ditches covering a few farms to the large incorporated mutual systems serving 50,000 to 60,000 acres.

The principal difficulty over the years has been the limited and variable water supply in relation to the irrigated acreage.

The annual supply entering the District is composed of the mountain flow of the Poudre, Thompson and St. Vrain Rivers and Boulder Creek, plus the discharge of the South Platte River at Fort Lupton.

This supply has varied from only 420,000 acre-feet (in 1934) to a maximum of nearly 1,500,000 in several years since 1905. The average yield has been about 905,000 or just over 1 acre-foot per acre of irrigated land.

While return flows to the streams increase the amounts available, the main benefits from this source are on the lower reaches of the South Platte River so that the total average supply for the upper part of the District is barely 1½ acre-feet per acre. In many years it has been much less.

It is considered by most irrigation men that for the usual diversified crops on the average soils in this area about 2½ acre-feet per acre are necessary and that a large portion of this should be stored water subject to call for use in maturing late row crops of higher value. In recent years the natural trend toward the production of more of this type of crops has been limited by the short supply of dependable late water.

The above briefly outlines the reasons why the people of Northern Colorado have initiated and supported the program for the diversion of additional water from the Colorado River as the only method by which the economic foundation of the region can be stabilized and the future development assured.

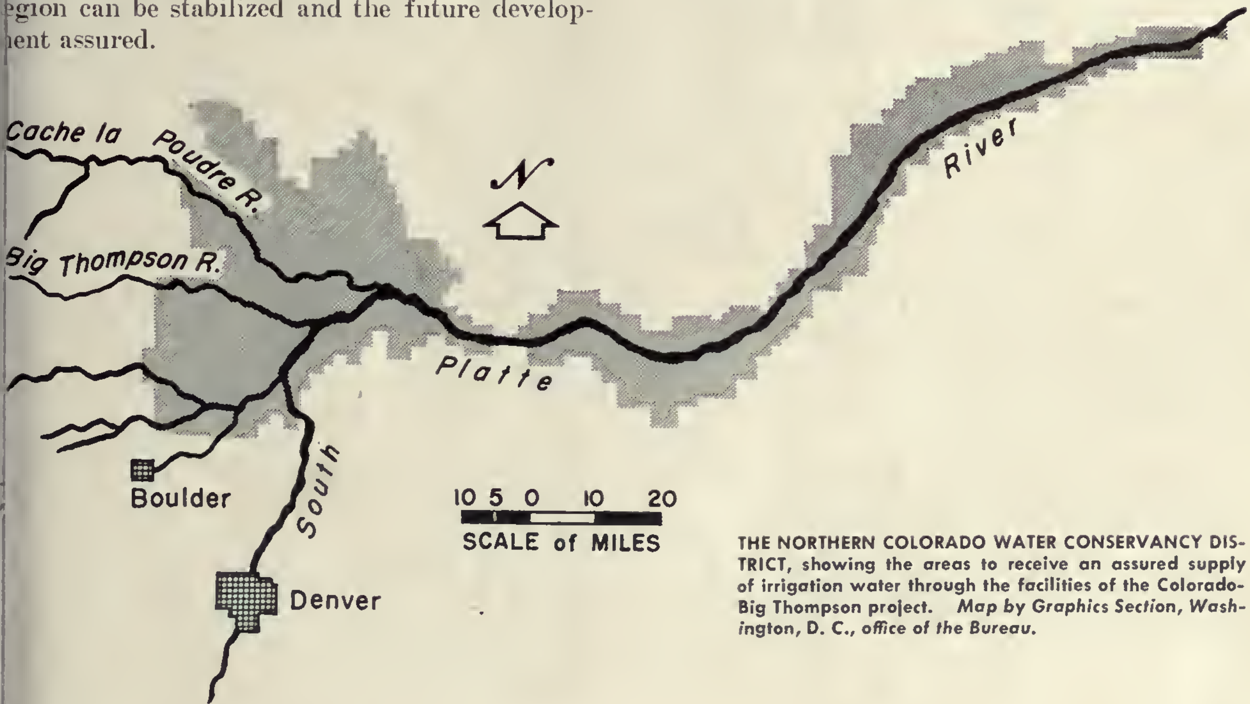
The idea of bringing water from the Colorado River has existed for over 50 years and numerous attempts were made to develop a practicable plan; but the present program was started in August 1933, when a group of men organized the Northern Colorado Water Users Association to determine, once and for all, whether a feasible plan were possible. A modest fund was donated by public-spirited agencies and individuals and a preliminary survey and a report was prepared under direction of R. J. Tipton, consulting engineer of Denver.

Briefly, this report concluded that it was feasible to divert about 300,000 acre-feet of water from the Colorado River and that the irrigation and power benefits would justify the cost.

In April 1934, the report was presented to a meeting of the representatives of the irrigation systems in the area with the result that a committee of 11 was appointed with instructions to use every effort to push the program.

Using the Tipton report as a basis, the plan was presented to our delegation in Congress and to Washington agencies with the result that in January 1935, Secretary Harold L. Ickes allotted $150,000 to the Bureau of Reclamation to conduct a complete survey and report on the feasibility of the proposed project.

(NEXT MONTH—ORGANIZING THE DISTRICT)



THE NORTHERN COLORADO WATER CONSERVANCY DISTRICT, showing the areas to receive an assured supply of irrigation water through the facilities of the Colorado-Big Thompson project. ***Map by Graphics Section, Washington, D. C., office of the Bureau.***

The Valley of the Milk River

(Continued from page 102)

Fork of the Milk River was completed in 1915 and storage water from Sherburne Lakes Reservoir was diverted to the Milk River in 1917.

When the Utah-Idaho Sugar Co. constructed a beet sugar factory at Chinook in 1925, some of the ranchers and farmers in the area who had been accustomed to irrigate only as a last resort started raising sugar beets, a rather unusual venture in the predominantly dry-farming area. More diversified crops began to make their appearance with the completion of Fresno Dam in 1939, providing facilities for storing water on the project during the winter, and putting an end to the enforced 2 or 3 weeks of delayed planting time in the spring when irrigation farmers had to wait for the ice to melt in Glacier Park and free the water for its journey from Sherburne Lakes to the Milk River project lands.

With the availability of stored water, irrigators on the Milk River project learned the value of improving their farming practices. Rough lands, a meandering river with high river banks, some heavy clay soils which warm up slowly in the spring and puddle and bake readily, require careful irrigation and drainage.

Since 1940, excellent crops of alfalfa, alfalfa seed, sweet clover, and some of the cereal grains have been produced indicating that the land, if properly handled, has a higher potential than past records would indicate.

The native blue joint hay produced on these lands has been a stabilizing influence in Northern Montana for many years, being highly regarded for livestock feeding by the residents of the area. However, the average per-acre yield of native hay is less than 1 ton while alfalfa hay, in 1950, averaged 2.5 tons per acre over the project area and 1.7 tons per acre on the heavier soils. Realizing they have a chance to double their yields, many of the landholders are abandoning their wild-flooding practices, and breaking up the native sod to establish a more profitable type of culture. Hay and forage produced on the project in 1950 totaled 54,000 tons and there were 20,000 acres of pastures, including 6,183 acres of beet tops. Crop census data for 1940 indicated 28,000 tons of hay and forage with 11,000 acres of pastures, showing an increase of practically 100 percent during a 10-year period when grain prices were at an all-time high.

The earlier unstable practice of raising hay and grain for market is gradually being replaced by a program which utilizes all potential feed on the land that produces it. Replacement of soil nutrients through livestock pasturing and feeding, application of commercial fertilizer, and plowing under of green manure crops is gaining more attention as the present program develops. Sugar beets are now the major "cash crop" successfully produced on the Milk River project. Feeding the beet tops to livestock, either by pasturing in the field or feeding in the feed lot, is becoming a common practice, improving income and aiding in retention of soil fertility. Growers are further using beet by-products through purchase of dehydrated pulp from the sugar beet factory at Chinook, Mont.

As the better soils are brought under intensified, diversified irrigation-farming practices, the holders of the heavier soils have become interested in developing new cultural practices on their lands and considerable progress has been made.

Ranchers in the area, who have acquired irri- gated tracts, pasture their livestock on their range lands during the summer months but bring them to the valley lands for winter feeding. Thus dry- land wheat farming, stock raising and irrigated agriculture are being combined to establish a most desirable type of operation.

These multiple-type operators, as well as many of the operators whose activities are confined entirely to irrigated tracts, are making livestock the basic factor in all their farming activities. The value of tame seeded pastures is gaining rec- ognition in both types of operation and mor acres are being utilized for this purpose each year. Further, good pasture mixes do well on some o the heavier soils thus offering another means o securing higher returns from the poorer land Although large acreages will undoubtedly be re tained for production of native hay, the mo highly developed lands will supplement the lo yields on that acreage with higher yields an greater per-acre returns.

As the land development program continue additional acres that have been idle for many yea are being brought under irrigation, thus enhanci project income.

Many problems remain to be solved, but t Milk River project is beginning to realize its f potential of productivity.

(Next Month—A Milk River Ranch)

Recreation at Reclamation Reservoirs

ıst January the first Federal-State agreement ıdministration of recreational facilities at one ıe man-made lakes created by the Bureau of amation in the Missouri River Basin was ed, turning over the control and maintenance he reservoir and surrounding land at Bonny ı to the State Fish and Game Department of orado. The agreement which will run for 25 s does not include the dam, caretaker's resi-e, and grounds. All recreational development oth the Bureau and the State has followed the ı drawn up by the National Park Service and Fish and Wildlife Service.

similar agreement was signed in February for e operation of the Heart Butte Reservoir in th Dakota, and an agreement for State oper-n of the recreational areas at Enders and Medi- Creek Reservoirs and Swanson Lake, the three rvoirs of the Frenchman-Cambridge Division Nebraska, was awaiting formal confirmation his issue went to press.

BONNY RECREATION UNDER STATE CONTROL—Signing an agreement for operation of the recreational features of Bonny Reservoir are (from left to right) Colorado's Gov. Dan Thornton, Avery A. Batson, Director of Region 7 for the Bureau of Reclamation, and Cleland N. Feast, Director of the Colorado Game and Fish Commission on January 25, 1952. Scene is the Governor's office, State Capitol Building. *Photo by N. T. Novitt, Region 7 photographer.*

In signing the first agreement for operation of Bonny Dam's recreational area, the Bureau of Reclamation's Regional Director at Denver, Colo., Mr. Avery Batson, pointed out that this is a perfect example of the cooperation that exists between the Federal Government and the States in the Missouri River Basin development. •

Summer Study of Northwest Resources

Oregon State College announces the 4th Insti- of Northwest Resources to be held on the pus at Corvallis June 23 to July 5.

he 2-week session is open to all adults inter-d in conservation and development of natural ources. Three credits at the graduate level may arned by qualified persons. Those not desiring lit are welcome to register as auditors but pay regular registration fee.

he 4th Institute will emphasize recreational forest resources of southwestern Oregon. om June 23 to June 26 members will meet on the vallis campus in seminar discussions of natural ources under the leadership of Prof. J. G. Jen-, Associate Prof. R. M. Highsmith, Associate of. W. G. Myatt and Asst. Prof. O. H. Heintzel-n of the Department of Natural Resources. om June 27 to July 5 opportunity will be pro-ed to observe recreational and forest resources southwest Oregon, including the spectacular egon coast, the Rogue River country, the Red-ods, Klamath Falls, and Crater Lake. The rty will travel by roomy sightseeing bus, under sonal leadership of Professors Heintzelman l Jensen, with frequent stops for picture-taking and detailed observations in cooperation with local leaders.

Advance reservation is required and must be accompanied by a $30 transportation fee. All other expenses including housing and meals and college registration fee of $21 are paid directly by individuals.

For additional information and a printed folder of information, write to Department of Natural Resources, Oregon State College, Corvallis, Oreg. •

Time to Renew?

You'll find the expiration date of your subscription on the address stamped on the back of your copy of the RECLAMATION ERA. If the number at the left-hand side of the address, directly beneath the number and street reads "6–52," for example, the last issue under your subscription will be the 6th month—June—of the year 1952.

Make sure that you will receive all copies of the RECLAMATION ERA by mailing your renewal at least 2 months before your present subscription expires.

Just send your payment of $1.50 (or $1 if you are a water user or Bureau employee) for 1 year, along with a clipping or copy of your address stamp to Commissioner, Bureau of Reclamation, Washington 25, D. C. Make money orders or checks payable to the Treasurer of the United States. Coins or currency will be accepted—but no stamps, please.

WATER REPORT

OUTLOOK FOR 1952 WATER SUPPLY OF THE WEST

by R. A. WORK, Senior Irrigation Engineer, and CLYDE E. HOUSTON, Irrigation Engineer, both of the Soil Conservation Service, United States Department of Agriculture.

Fifty years of organized land reclamation has brought water and life to the latently fertile desert resulting in a productivity that it had never before known. Water has been the miracle worker in the hands of those who understood it, but its certainty of supply could not be foretold by a distant look at the mountains. Thus from the need to know "how much" came the science of snow surveying, and snow surveyors took their place in the long chain of those who are leading nature to produce a more bountiful harvest.

Snow surveys initiated by the Bureau of Reclamation in the Wyoming headwaters of the Snake in 1919, are the earliest snow surveys initiated by any governmental agency.

Foreknowledge of the water supply means much to the men who are bringing it to the farmers—as well as to the farmers themselves. The days of frosty toil and the hours of calculating snow figures—down through the years since these measurements were first taken—are now culminating in a greater accuracy of summer water supply forecasting at a time when the West needs it the most.

Snow surveyors who made their lonely treks into the frozen watersheds of Western States this winter have done so with pride in the realization that they too are contributing to the development of this great area.

The snow surveyors salute Reclamation with all best wishes on occasion of this Golden Jubilee, and have arranged a record-breaking snow crop for most of the western watersheds contributing to Bureau projects. On many snow courses from Canada to the southwestern United States, fro the Pacific to the Rocky Mountains, snow sur veyors report "more snow water than ever befor measured." Only in southern Arizona and New Mexico does the 10-year drought continue. Th following State by State inventory gives a mor detailed accounting of irrigation season run-o prospects, as reported to the Soil Conservatio Service[1] by the snow surveys.

Arizona—prospects for runoff into the reservoirs of th Salt and Verde Rivers are the best in the past 10 year The watersheds of these rivers now store more water i snow than in any previous year of record. Soils on thes watersheds are saturated.

The Verde River reservoirs should fill and spill befor the middle of April. By the end of May an additiona 150,000 acre-feet will flow past the gauging station a Horseshoe Dam on the Verde.

It is forecast that for April–June, inclusive, 500,0 acre feet of water will pass the gauging station at Roos velt Dam. This should bring the reservoirs of the Sal River nearly to 90 percent capacity. With favorabl weather conditions it is possible that these reservoir may fill.

The outlook for runoff on the Gila River is not nearl as bright as on the other watersheds of the State. Sa Carlos reservoir in April first stored water only to abou 13 percent of capacity. Runoff may bring this storag to no higher than 15 percent of capacity. Soil moistur conditions are good on the Gila watershed but there i not sufficient snow cover to insure a good runoff.

Runoff into the Little Colorado will be considerabl above normal.

Storage in Carl Pleasant dam was at 75 percent capacity, or about 136,000 acre-feet on April 1. It possible that runoff may bring this storage to maximu of 150,000 acre-feet. Current irrigation requirements a keeping the storage down. Excluding San Carlos rese voir on the Gila River System, the State will enter t irrigation season with all reservoirs at or near capacit

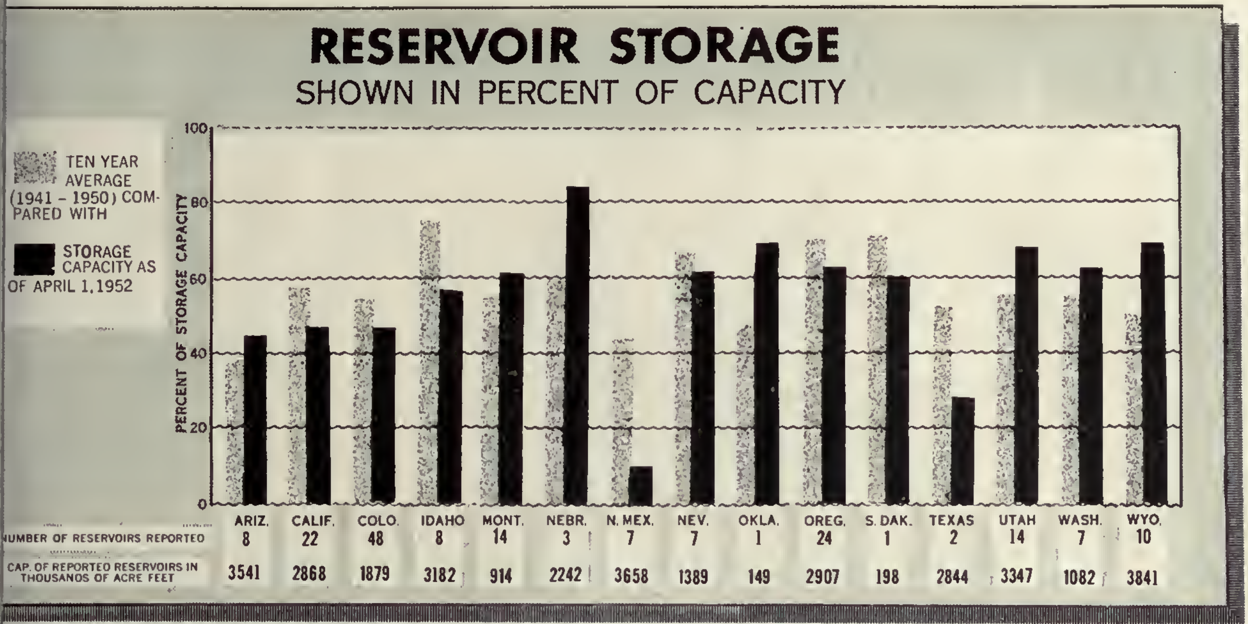
California—runoff from snow melt in California, as ind cated from April 1st snow surveys will be the greate since snow surveys began 22 years ago. Only on t watershed above Shasta dam, among the major wate sheds tributary to Sacramento Valley, is the forecast less than the 1938 April through July flow. Runoff fro the Upper Sacramento River watershed is expected to about 92 percent of 1938.

On watersheds draining west from the central Sier (Feather, Yuba, and American Rivers) April–July run is expected to be the greatest since 1890.

Sierra streams tributary to the San Joaquin Valley m produce flows that will cause local flooding of low-ly agricultural lands where the tributaries meet the ma stem of San Joaquin River.

On the extreme southern watersheds of the Sierra, in cated runoff will be of such proportions that Buena Vis Lake and Tulare Lake basins will be flooded to appro mately the same extent as in 1938. However, it is und stood that as much as 300,000 acre-feet of space may

[1] The Division of Irrigation Engineering and Water Conservation is the Federal Coordinating agency of snow surveys conducted by its staff and many cooperators, including the Bureau of Reclamation, Forest Service, National Park Service, Geological Survey, various departments of the several Western States, irrigation districts, power companies, and others. The California State Division of Water Resources conducts and coordinates snow surveys in that State, while the British Columbia Department of Lands and Forests, Water Rights Branch, has charge of the snow surveys in that province.



ost State averages for reported reservoirs are for full 10-year period, but in a few cases reservoirs having shorter records are included. ALIFORNIA—does not include Millerton or Shasta reservoirs which have a combined capacity of 5,020,500 acre-feet, and whose comned storage on April 1st was 4,243,400 acre-feet. COLORADO—does not include John Martin reservoir (capacity 685,000 acre-et) with April 1st storage of 12,390,000 acre-feet, nor Flathead Lake (capacity 1,791,000 acre-feet) with April 1st storage of 572,300 re-feet; and Hungry Horse reservoir which stored 68,080 acre-feet on April 1st and will store up to 1,000,000 acre-feet this spring. EVADA—does not include Lake Mead (capacity 27,217,000 acre-feet) with April 1st storage of 15,691,444 acre-feet. OKLAOMA—new reservoir in 1945. WASHINGTON—does not include Roosevelt Lake (capacity 5,220,000 acre-feet) with April 1st storage 1,700,000 acre-feet. WYOMING—does not include Boysen Reservoir with capacity of 820,000 acre-feet and April 1st storage of 2,400 acre-feet. (These are total capacities. The table on page 125 shows active capacity available for irrigation.—Ed.).

ade available in partially completed Piue Flat reservoir pstream on King's River. If this should prove the case, -flow to Tulare Lake could be material reduced.

All major reservoirs fed by Sierra streams are expected fill before the end of the snow run-off period, even hough some have been materially lowered in anticipation large in-flows to come.

All of the above predictions, in commou with those for her States, are based upon the assumptiou that nearormal temperatures and precipitation will prevail during e April–July period.

COLORADO—water content of mountain snow on April 1, 952, on 90 percent of the courses, exceeds all previous easurements since snow surveys were started in 1936. he summer flow of all streams will be much above normal. he flow of most streams will be higher than for any ear since 1936 and the flow of some may set new records. hese unusually high flows are expected from the Rio rande in Colorado, and on the San Juan and Dolores ivers in southwestern Colorado. The flow of all Coloado River tributaries in Colorado will probably exceed he last highest year which was 1941. The flow of the outh Platte, Arkansas and their tributaries will be as igh as for any year in the past 10 and may exceed this ecord if rainfall of normal or greater proportions occurs efore or during the snow melt season.

Storage in irrigation reservoirs on the South Platte ystem is well above average. On the Lower South Platte, rrigation reservoirs are near capacity. On the Arkansas nd Rio Grande drainages, storage in irrigation reseroirs is much below average and in many cases reseroirs are almost empty.

Soil moisture couditions over the State are good except n the Arkansas River Valley where soil moisture is fair o poor.

IDAHO—all watersheds in Idaho have a heavy snow pack which assures excellent water supplies for irrigation and ower generation within the State.

Snow at both high and low levels is well above average. Cool temperatures that have prevailed to date have prevented melt of all snow except that at the very lowest elevations. A few weeks more of cool weather could result in serious high water potentials on the Big Wood, Boise, Big Lost, Payette, Weiser, and Kootenai Rivers. Heavy volume flows are forecast on these rivers assuming normal melt conditions throughout the snow melt season. Several reservoirs have been lowered for maximum use in flood control.

MONTANA—April 1st snow measurements made over the Upper Missouri and Upper Columbia River basins generally indicate a very good water supply for irrigation this coming season. Snow cover of the Upper Columbia basin in Montana is appreciably above average even though the snow accumulation during March was below average.

However, on the Sun river basin, the water content of the snow is just slightly below normal, although not enough as to promise any serious shortage of later runoff.

Snow cover on the Upper Missouri River is about 140 percent of the past 16-year average.

Reservoir storage throughout Montana is very satisfactory.

NEVADA—snow stored water is greater than ever before measured on most of the courses in Nevada. High elevation snow throughout the State is about twice normal, while low snow ranges from three to four times normal.

October through March streamflow along the Humboldt and Eastern Sierra is near normal. In these areas ground water levels are normal or above.

Summer streamflow forecasts throughout the State range from a minimum of 140 percent of normal to a maximum of 307 percent.

Reservoir storage on April 1 was about 60 percent of capacity and 90 percent of the past ten-year average. Storage in Eastern Sierra reservoirs is being decreased to furnish a cushion for the expected high summer flow.

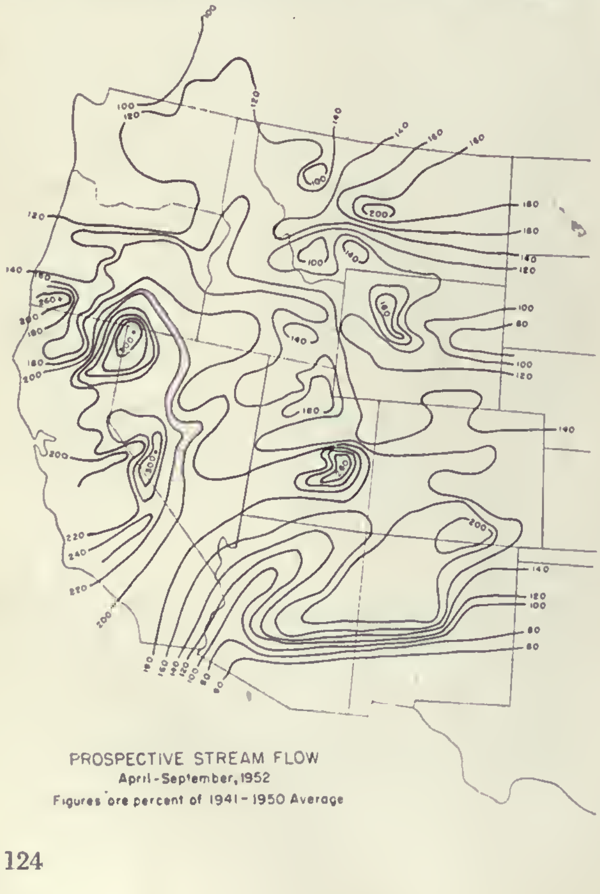
NEW MEXICO—snow accumulation in northern New Mexico is very high near the Colorado-New Mexico line. The amount of snow in respect to normal decreases rapidly to the South. Near Santa Fe and to the west in the Jemez Mountains the snow cover is near normal. Summer stream flow will follow the same general pattern. All Rio Grande reservoirs are practically empty. Residual storage in Elephant Butte reservoir at the end of the coming irrigation season will probably be less than one-half capacity. Soil moisture conditions in valley areas are reported as fair to poor.

Because of the relatively high flow expected for the Rio Grande and its tributaries in San Luis Valley, the probability of extensive flood damage there is rather high. This is particularly true on the Conejos River where some flood damage occurs almost every year.

In view of the preparations that have been made to control the flow of the Rio Grande at Albuquerque, the probability of extreme flood damage will depend upon the strength of the levees. In other less well protected areas along the Rio Grande, damage may be expected.

OREGON—water supplies for 1952, based on mountain snows should be abundant as State-wide snow cover is 168 percent average. Snow cover below 5,000 feet is even greater in relation to average than the higher level snows. Streamflow for the April–September period should break many historical records on the following drainages: Owyhee, John Day, Harney Basin, Deschutes, Crooked, North Umpqua, Main Rogue, Applegate, Illinois, Williamson, Sprague, Deep Creek, and Chewaucan Rivers.

Extremes of high water with some record-breaking flows have already been received in many areas but the potential hazard remaining in the present snow cover is great and under adverse melting conditions could easily produce damaging flows in any of the above drainages.



PROSPECTIVE STREAM FLOW
April-September, 1952
Figures are percent of 1941–1950 Average

Reservoirs storage has improved considerably in the past month and is now satisfactory.

SOUTH DAKOTA—snow cover in the Black Hills area of South Dakota is well above normal for this date. Soil moisture conditions are reported as fair to good in irrigated areas. Current storage and prospective runoff is considered to be adequate for irrigation needs.

UTAH—all parts of the State have an excellent water supply for the coming summer in snow storage on mountain watershed. Forecast run-off expressed as a percent of the April–September ten year (1941–50) average varies from 125 percent of normal on Ashley Creek in the Uintah Basin to 257 percent on the Price River. Since 55 of 69 snow courses having long time records have equaled or considerably exceeded previous record water content measurements, the great volume of snow water can be expected to produce record or near record peak flows on nearly all streams, with considerable damage to farmlands, homes and other structures in vulnerable areas. Where possible, reservoir storage is being reduced to allow a cushion for peak flows.

Reservoir storage varies considerably over the State. The reservoirs of the Weber-Ogden system held only 16 percent of capacity, having been drawn down so that they can reduce peak streamflows. In the Sevier and Beaver river reservoirs, storage is 42 percent of capacity and 52 percent of the 10-year average, reflecting the low water supplies of the last two years.

Average for all reservoirs in the State is 69 percent of capacity and 124 percent of the 10-year average.

WASHINGTON—water supply forecasts in Washington are good to excellent for the 1952 season. Relatively heavy volume flows are expected on the Lower Columbia, Spokane, and Okanogan Rivers. If these large volumes remain in the mountains until late in the snow melt season, damaging high water could result from a rapid snow melt.

The water stored in snow on the mountains in British Columbia, which furnish nearly half the water to the main stem of Columbia River, ranges up to 125 percent of normal on the East Okanogan. The remainder of Columbia Basin in the United States has a heavy snow pack which will contribute to high run-off. The combination of heavy fall precipitation and snow stored water are higher as of April 1st than in any other year of the 17 year period of snow recorded.

WYOMING—the snow water stored in the high watersheds of Western Wyoming varies from 26 to 46 percent above average. An excellent water supply is forecast for the Jackson Hole area and adjacent irrigated land in Idaho. The possibility of damaging high water in the Jackson bottoms if the snow melt run-off is delayed cannot be overlooked.

Snow water measured on the Green River watershed was slightly above normal and is probably the least above normal snow cover in the Rocky Mountain area.

Summer run-off of North Platte river will be very high. April–September flow of the North Platte at Saratoga will probably exceed 1,000,000 acre-feet. Because the available capacity of the North Platte reservoir system as of this date is about one-half of this amount, the whole system will probably spill this year for the first time since the system was completed. The flow of the Laramie River will also be high. Soil moisture conditions on the irrigated areas of the North Platte in eastern Wyoming and Western Nebraska are good.

Snow cover on the Wind River basin in Wyoming averages slightly below normal. Water supplied from this basin is not expected to be as great as during the past two years, but should not be much below normal.

BRITISH COLUMBIA—snow situation this year throughout the Province is rather mixed. The possibility of flooding cannot be ignored and will depend upon the temperature and precipitation distribution during the snow melt season. # # #

Water Stored in Reclamation Reservoirs

Location	Project	Reservoir	Storage (in acre-feet)		
			Active capacity [1]	Mar. 31, 1951	Mar. 31, 1952
ion 1	Baker	Thief Valley	17,400	18,100	[2]
	Bitter Root	Lake Como	34,800	20,000	13,600
	Boise	Anderson Ranch	464,200	329,800	70,300
		Arrowrock	286,500	167,700	19,600
		Cascade	650,000	900	110,800
		Deadwood	161,900	109,100	31,900
		Lake Lowell	169,000	157,600	148,200
	Burnt River	Unity	24,600	15,000	7,200
	Columbia Basin	F. D. Roosevelt	5,220,000	4,749,000	1,070,000
	Deschutes	Crane Prairie	50,000	53,000	47,000
		Wickiup	182,000	188,000	177,000
	Minidoka	American Falls	1,700,000	1,389,200	1,392,200
		Jackson Lake	847,000	459,600	520,000
		Lake Walcott	95,200	89,200	80,000
		Grassy Lake	15,200	13,200	13,200
		Island Park	127,300	115,000	74,800
	Okanogan	Conconully	13,200	7,600	8,400
		Salmon Lake	10,500	10,000	10,100
	Owyhee	Owyhee	715,000	715,000	531,200
	Umatilla	Cold Springs	50,000	50,000	49,600
		McKay	73,800	64,300	44,600
	Vale	Agency Valley	60,000	32,900	38,700
		Warm Springs	191,000	82,600	90,000
	Yakima	Bumping Lake	[3] 33,800	5,200	4,800
		Cle Elum	435,700	256,700	258,900
		Kachess	239,000	174,700	184,300
		Keechelus	153,000	65,900	86,100
		Tieton	197,000	106,200	123,100
ion 2	Central Valley	Millerton Lake	500,000	339,400	247,800
		Shasta	4,366,800	3,525,200	3,849,200
	Klamath	Clear Lake	513,300	139,300	156,800
		Gerber	94,300	57,600	26,200
		Upper Klamath Lake	524,800	441,300	323,500
	Orland	East Park	50,600	49,300	48,500
		Stony Gorge	50,000	51,000	48,900
gion 3	Boulder Canyon	Lake Mead	27,207,000	16,806,000	15,691,000
	Davis Dam	Lake Mohave	1,809,800	1,549,700	1,586,500
	Parker Dam Power	Havasu	688,000	605,700	600,900
	Salt River	Bartlett	179,500	6,000	156,000
		Horse Mesa	245,000	136,000	233,000
		Horseshoe	144,000	1,000	118,000
		Mormon Flat	57,800	54,000	52,000
		Roosevelt	1,381,600	5,000	682,000
		Stewart Mountain	69,800	48,000	50,000
gion 4	Fruit Growers	Fruit Growers	4,500	3,000	300
	Humboldt	Rye Patch	179,000	109,100	114,700
	Hyrum	Hyrum	15,300	10,300	10,400
	Mancos	Jackson Gulch	9,800	2,400	800
	Moon Lake	Midview	5,800	5,200	4,500
		Moon Lake	35,800	20,500	22,700
	Newlands	Lahontan	290,900	234,600	146,400
		Lake Tahoe	732,000	592,800	504,000
	Newton	Newton	5,400	5,100	3,500
	Ogden River	Pine View	44,200	10,200	3,200
	Pine River	Vallecito	126,300	27,100	26,600
	Provo River	Deer Creek	149,700	124,100	108,700
	Scofield	Scofield	65,800	32,200	33,800
	Strawberry Valley	Strawberry	270,000	141,500	153,300
	Truckee River Storage	Boca	40,900	19,400	2,700
	Uncompahgre	Taylor Park	106,200	51,100	55,500
	Weber River	Echo	73,900	48,200	13,300
egion 5	W. C. Austin	Altus	145,000	145,000	99,200
	Balmorhea	Lower Parks	5,900	6,600	6,400
	Carlsbad	Alamogordo	131,900	81,800	23,200
		Avalon	6,600	1,100	1,800
		McMillen	38,700	9,800	[2]
	Colorado River	Marshall Ford	810,500	47,100	21,500
	Rio Grande	Caballo	345,900	154,200	78,600
		Elephant Butte	2,197,600	255,200	19,100
	Tucumcari	Conchas	269,100	182,500	108,700
egion 6	Missouri River Basin	Angostura	92,000	32,000	41,000
		Boysen	560,000	----------	152,400
		Heart Butte	68,700	111,900	60,700
	Belle Fourche	Belle Fourche	185,200	94,300	117,800
	Fort Peck	Fort Peck	11,400,000	8,389,200	7,821,500
	Milk River	Fresno	127,200	99,900	145,000
		Nelson	68,800	16,700	37,000
		Sherburne Lakes	66,100	30,500	[2]
	Rapid Valley	Deerfield	15,100	14,100	15,100
	Riverton	Bull Lake	155,000	79,500	61,200
		Pilot Butte	31,600	13,800	13,600
	Shoshone	Buffalo Bill	394,600	269,100	202,300
	Sun River	Gibson	105,000	80,600	66,900
		Pishkun	30,100	18,900	23,000
		Willow Creek	32,400	26,000	25,400
egion 7	Colorado-Big Thompson	Granby	467,600	46,000	201,900
		Green Mountain	146,900	54,800	77,000
		Horsetooth	151,700	----------	68,700
		Shadow Mountain	1,800	1,600	1,400
	Missouri River Basin	Bonny	[2]	----------	33,400
		Cedar Bluff	131,700	----------	97,400
		Enders	36,000	9,100	30,400
		Medicine Creek	35,000	34,100	33,400
	Kendrick	Alcova	190,300	169,500	158,800
		Seminoe	993,200	491,700	502,800
	Mirage Flats	Box Butte	30,600	23,500	31,200
	North Platte	Guernsey	44,200	39,700	34,900
		Lake Alice	11,400	[2]	[2]
		Lake Minatare	60,800	25,400	28,200
		Pathfinder	1,040,500	963,300	937,000

[1] Available for irrigation.

[2] Not reported.

LETTERS

Thank You, Mr. Mercer!

BUREAU OF RECLAMATION,
D. F. C.
Denver 15, Colo., March 4, 1952.

DEAR EDITOR: Please accept my sincere thanks for the very nice writeup of my career which appeared in the February 1952 Reclamation Era. May I also congratulate you on the very fine appearance of the publication from an editorial point of view. Your selection and preparation of material is above reproach.

With kindest personal regards, I am very truly yours,

(S) WILLIAM H. MERCER.

Hail, Columbia!

COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK,
NEW YORK 27, N. Y.,
GRADUATE SCHOOL OF BUSINESS,
February 27, 1952.

DEAR MR. STRAUS: Would it be possible to obtain from your Bureau five copies of the August 1951 issue of the Reclamation Era? As you will recall, this issue is devoted to the Central Valley Project of California. I should very much like to assign the various articles in that issue as required reading for my students in my course entitled "The Industries and Resources of the United States."

Since I have more than 40 students in the class, 5 copies of your magazine would give all of these individuals an opportunity to read the articles in the library. Whatever you can do for me will be greatly appreciated.

Sincerely yours,

HERMAN F. OTTE
Associate Professor,
Economic Geography.

We are very happy to learn that articles contained in the RECLAMATION ERA are being used as assignments in such a prominent institution as Columbia University.—Ed.

CROPS

RECLAMATION PAYOFF

California's "Sacramento Bee," issue of March 14, 1952, carried the following news item:

"A report of the Modoc County Agriculture Department shows the Tulelake section produced about 40 percent of the total agricultural income of the county both in 1950 and 1951, although it contains less than 12 percent of the total cropland.

"The difference is the Tulelake section is in a reclamation district. Could there be a more striking proof that the investment in reclamation projects pays off handsomely in increased agricultural production and in increased wealth?" ●

Crop Production Reaches New Peak

More than 16 million tons of foodstuffs, forage and fiber crops were harvested in 1951 from irrigated farms served by the Bureau of Reclamation.

The volume as well as the gross value of $654,019,527 established new high records for production from federally irrigated farms. This is the first time the total value of a year's production has gone over the $600 million mark.

While some of the increased value is attributable to higher farm prices it also reflects increased production per acre and additional acreage in cultivation. The 1950 crop was valued at $578,237,709. Total acreage in cultivation in 1951 was 5,410,439 compared with 5,189,463 the previous year. Average per acre value of 1951 production was $120.88 compared with $111.43 in 1950. The figures do not include the value of livestock which is normally an important part of diversified farm production on most family size irrigated farms in the West. Commissioner of Reclamation Michael W. Straus made it plain that the total represents the harvest not only from land receiving a full supply of irrigation water from federally constructed works but also land which receives a supplemental supply from this source. ●

Provo River Crops Worth a Million More Than in 1950

Preliminary crop report estimates from Utah's Provo River project—Region 4—indicate that the gross value of crops grown on that project during 1951 will top the 1950 value by over a million dollars, representing a 38-percent increase. In 1950 the gross value of crops was $2,895,000 while estimates indicate that the 1951 value will be in the neighborhood of $4,000,000.

This tremendous increase in value occurred because of favorable prices and yields in fruit crops, a principal part of the total. ●

FOREIGN ACTIVITIE

The Foreign Activities program
the Bureau of Reclamation continue
grow as the countries of the world r
ize the importance of water resour
development. Assistance to for
countries is provided without any
to the Bureau of Reclamation. S
the first of the year Bureau of Recla
tion technicians have been on the
lowing foreign assignments:

LEBANON.—The staff for phase
the Litani River project investigati
has continued to build up in Leba
augmenting the two-man interim s
consisting of Mr. L. J. Snyder and
Ralph Winchell of the Commission
office in Washington, D. C., who h
been there since September. Now
duty at Litani are Mr. R. F. Herdm
project manager, formerly construc
engineer at Yellowtail Dam, Mr. S
ner B. Foster, electrical engineer, f
the Division of Design and Const
tion in Denver, Colo., Mr. Fred
Houck, in charge of engineering des
also from Design and Construct
Denver, Colo., and Mr. M. R. Lewis
charge of land use, formerly of
O & M staff in Washington. Leste
Robb, irrigation engineer from Re
6, David H. M. Strong, engineering
spector, from Region 6, William
Thompson, geologist from Design
Construction, Denver, Colo., V
Meissner, materials engineer from
sign and Construction, Denver, C
Frederick Keay, engineering drafts
from Design and Construction, De
Colo., M. R. Parrish, office eng
from Denver, Colo.; R. M. Hougen,
trical engineer from Denver, Colo.,
R. F. Kaser, hydrologist from Re
3. The majority of these men
been accompanied by their families
report in glowing terms of the spa
apartments they have rented, the
ant climate and the picturesque
world atmosphere encountered
Beirut.

IRAQ.—Assistant Commissioner
ley R. Nelson resigned in Februa
take a State Department positi
Iraq as a member of the Iraq De
ment Board. In this position h
have responsibility along with
Iraqi and one British member
Board to advise the Government
vantageous expenditures of its
come in order to expand the ec
of the country and improve its sta

ing. Mr. Nelson will be principally erned with the river basin development of Iraq in order that its great s, the Tigris and the Euphrates, be applied to its fertile soil. Other rtant features in the control of r are the elimination of annual disus floods and the generation of oelectric power for industrial exon. Mr. William H. Farmer, acanied by his family, also left for in March. Mr. Farmer, formerly akima, Wash., will advise on irrin practices and procedures in Iraq. exceptional opportunity exists in for improvement of irrigation ices and in application of irrigavater to prevent lands from becomwater-logged and unproductive ise of increased salinity.

AN.—Mr. Anthony J. Perry is cury engaged in a reconnaissance of ydroelectric potential of Iran. He forerunner of many more Bureau icians whose services have been ntly requested in Iran by former stant Secretary of the Interior, am E. Warne.

KISTAN.—At the request of the nical Cooperation Administration top-flight drainage engineer, Mr. les R. Meierhofer, head of the ndwater and drainage branch of n and Construction, Denver, Colo. he middle of March for a 30- to 60-detail in Pakistan to make recomlations concerning methods of reng excess salts from the soil and elp solve other problems relating e drainage and reclamation of exve areas of once-productive farmin Pakistan.

DIA.—The Central Water and er Commission of India is one of oremost irrigation organizations in world. The exchange of technical and the degree of professional unanding and respect existing ben the CWPC and the Bureau of amation is most cordial. At the est of the Government of India the nical Cooperation Administration, ugh its Point 4 program, is providhe funds for 6 Bureau of Reclamaengineers to serve as advisors to engineering sections of the CWPC. Clarence Rawhouser, formerly of Dams Division in Design and Contion, Denver, Colo. left in January New Delhi to serve as advisor to Dams Design Division of CWPC. Paul von der Lippe, formerly of the ctural and Architectural Division of Design and Construction in Denver, Colo., and a veteran of 3 years in Ceylon as advisor to the Ministry of Irrigation on the Gal Oye and other irrigation projects in that country, has gone to New Delhi as structural engineer advisor. Mr. von der Lippe was married during the middle of March in Copenhagen, Denmark, enroute to India. Mr. Clifford L. Mutch, former construction engineer for Bonny Dam, in Colorado, has gone to New Delhi as advisor on construction methods. Scheduled for departure in the near future are advisors on electrical engineering, mechanical engineering and concrete control.

In another field of technical assistance to India, Mr. David S. Stoner, head of Irrigation Operations for Region 2, is undertaking a reconnaissance of the possibilities of an extensive well-drilling program to be carried out in the area of the Ganges Plain and in the vicinity of Madras. It is hoped by means of approximately 2,000 large-capacity wells to increase the food production materially. On farms thus benefited, farmers will be able to raise two crops a year where only one crop would grow without irrigation.

ETHIOPIA.—Mr. Tom A. Clark and Mr. William H. Greenhaugh, both of Region 4, left early in April to make a reconnaissance and an evaluation of the potential river basin development at the head waters of the Blue Nile in Ethiopia.

LIBYA.—Mr. Hal. J. Jennings, formerly of Design and Construction in Denver, left early in April as the first member of a team of Bureau personnel which will advise on irrigation methods and undertake land classifications and horticultural advice and recommendations designed to increase the food production with the extremely limited quantities of water available for use in Libya. Libya is the newest country of the world, having been granted its independence from United Nations trusteeship at the beginning of this year.

CHILE—Mr. Tom Ahrens, ground-water geologist and Mr. Robert H. Keummich, seismological engineer, both of Design and Construction in Denver, with Mr. Victor Pinneo, drill superintendent of Region 7 in Denver are all in Chile engaged in a program of exploring the ground-water resources of the Rio Elqui Valley.

ISRAEL.—Mr. Harry Bashore, former Commissioner of Reclamation, spent the month of March in Israel as a consultant to that government on irrigation and related water development problems.

COSTA RICA.—Mr. William D. Romig, hydrologist from Project Planning in Washington, D. C., and Mr. Darwin H. Jepson, geologist, of Billings, Mont., Region 6, left the United States early in March and are now in western Costa Rica making a study of possibilities for an irrigation development in the Tempisque River valley. Their work should be completed in about 60 days, in order to finish their assignments before the beginning of the rainy season. ●

RELEASES

New Maps Available

The Drafting Section of the Bureau of Reclamation has recently completed five new project maps. They are of the Belle Fourche project in South Dakota, the Grand Valley project in Colorado, the Savage Unit of the Missouri River Basin project in Montana, and the Shoshone project in Wyoming. A single map covering all Federal Reclamation projects in the State of Utah concludes the list.

All maps are in color. The Belle Fourche and Savage Unit maps are available in the small size only (10½" x 17"). The others are available in both small and large (21" x 34") sizes. Requests should be sent to the nearest Regional Director (see list on inside back cover of this issue) specifying name and size of maps desired. Single copies are available free to those who need them in connection with their work or studies. ●

POSTSCRIPTS

CORRECTIONS FOR COLUMBIA BASIN ISSUE

Please correct your April 1952 special Columbia Basin issue of the Reclamation Era as follows: on the full-page map at the beginning of the magazine the map legend for the shaded blocks now read "Irrigation to begin in 1952"—add "1953". On pages 96 and 97, the photo credits designate Ralph Bennett as a Region 1 photographer. Insert "Ephrata Bureau Chief of Wenatchee World." Thank you.

NOTES FOR CONTRACTORS

Contracts Awarded During March 1952

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Co[...] am[...]
DS-3567	Missouri River Basin, Nebr.	Mar. 26	One 27,000/36,000-kilovolt-ampere transformer with three 115,000-volt and three 13,800-volt lightning arresters and 1 current transformer for Gering substation.	General Electric Co., Denver, Colo.	$1[...]
DS-3597	Missouri River Basin, S. Dak.	Mar. 21	One 12,000-kilovolt-ampere and one 15,000-kilovolt-ampere autotransformer each with 6 lightning arresters for Huron Mount Vernon substations, schedules 1 and 2.	Wagner Electric Corp., St. Louis, Mo.	1[...]
DS-3597	do	Mar. 24	One 15,000-kilovolt-ampere and one 7,500-kilovolt-ampere autotransformer each with 6 lightning arresters for Sioux Falls and Watertown substations, schedules 3 and 4.	General Electric Co., Denver, Colo.	
DS-3600	Missouri River Basin, Colo.-Kans.-Nebr.	Mar. 18	High-frequency AM radio equipment for Kansas River district, schedule 1.	American Electroneering Corp., Los Angeles, Calif.	
DS-3607	Central Valley, Calif.	Mar. 11	One 80,000-kilovolt-ampere autotransformer with three lightning arresters for Folsom power plant switchyard.	English Electric Co., Ltd., New York, N. Y.	
DS-3611	Fort Peck, Mont.	Mar. 24	One 750-kilovolt-ampere transformer with three lightning arresters, three 37.5-kilovolt-ampere transformers, and three 121,000-volt and three 9,000-volt lightning arresters for Dawson County substation, schedules 1, 2, and 9.	Electrical and Mechanical Supply Co., Inc., El Paso, Tex.	
DS-3616	Missouri River Basin, Mont.	Mar. 11	Three metal-clad switchgear assemblies for Canyon Ferry power plant, schedule 5.	General Electric Co., Denver, Colo.	
DS-3622	Palisades, Idaho	Mar. 31	160,000 barrels of bulk portland cement for construction of Palisades dam and power plant, schedule 1.	Idaho Portland Cement Co., Inkom, Idaho.	
DC-3634	Columbia Basin, Wash.	Mar. 28	Painting for Grand Coulee Dam, right power plant, and water tank.	F. O. Repine Co., Salem, Oreg.	
DS-3636	Colorado-Big Thompson, Colo.	Mar. 5	One 42-inch butterfly valve with operating mechanism and control system for pump-turbine bypass for Flatiron power and pumping plant.	Columbia Machine Works, Berkeley, Calif.	
DS-3637	do	do	One control for 84-inch butterfly valve for penstock intake at Flatiron power and pumping plant.	Hardinge Mfg. Co., York, Pa.	
DC-3638	Missouri River Basin, Mont.	Mar. 6	Furnishing and installing 1 electric elevator for Canyon Ferry Dam.	Gust. Lagerquist and Sons, Minneapolis, Minn.	
DS-3639	Missouri River Basin, N. Dak.	Mar. 10	Four 5- by 6-foot high-pressure gates with four 110,000-pound hydraulic hoists, 6 conduit linings, and 4 gate hangers for outlet works at Jamestown dam.	Hardie-Tynes Manufacturing Co., Birmingham, Ala.	
DS-3640	do	Mar. 26	Two 2,400-volt motor control equipment assemblies for Lower and Upper Saddle Gap pumping plants.	Ideal Electric and Manufacturing Co., Mansfield, Ohio.	
DS-3642	Missouri River Basin, Mont.	Mar. 10	Steel structures for 115-kilo-volts switchyard at Canyon Ferry power plant.	Creamer and Dunlap, Tulsa, Okla.	
DS-3644	Fort Peck, Mont.	Mar. 11	Two carrier-current relaying transmitter-receiver sets and one lot of unmounted meters, instruments, switches, and line protective and carrier-current relays for Dawson County and Miles City substations, schedule 1.	Westinghouse Electric Corp., Denver, Colo.	
DC-3646 and DC-3647	Missouri River Basin, S. Dak.	Mar. 5	Construction of Flandreau and Beresford substations	D. A. Gill Co., Inc., Sioux Falls, S. Dak.	
DC-3650	Colorado-Big Thompson, Colo.	Mar. 7	Construction of earthwork, canal lining, and structures for Pole Hill Canal, Estes Park-Foothills power aqueduct.	Colorado Constructors, Inc., Denver, Colo.	2[...]
DS-3654	do	Mar. 14	Eight bulkhead gates, one bulkhead, and one lifting frame for draft tubes, discharge tubes, and stilling basin at Flatiron power and pumping plant.	Thompson Pipe and Steel Co., Denver, Colo.	
DC-3656	Missouri River Basin, N. Dak.	Mar. 25	Construction of Jamestown Dam	C. F. Lytle Co., Sioux City, Iowa	1,8[...]
DC-3657	do	Mar. 24	Construction of earthwork, structures, tunnels, and canal lining for St. Vrain supply canal, schedules 1 and 4.	Winston Bros. Co., Monrovia, Calif.	2,2[...]
DC-3657	do	do	Construction of monolithic-concrete siphons for St. Vrain supply canal, schedule 2.	Adler Construction Co., Loveland, Colo.	
DC-3664	Columbia Basin, Wash.	Mar. 25	Terrazzo work in Grand Coulee power plants, pumping plant, machine shop, and dam.	P. Grassi and Co., and American Terrazzo Co., South San Francisco, Calif.	
117C-134	do	Mar. 18	Lot grading, streets, parking areas, sidewalks and curbs, sewerage, water and street lighting systems at Grand Coulee Dam.	George V. Nolte and Co., Bellingham, Wash.	
117C-137	do	Mar. 3	Landscaping O & M Headquarters sites and Ephrata office building, schedules 2, 3, 4, and 5.	Krause Nursery, Spokane, Wash.	
200C-191	Central Valley, Calif.	Mar. 17	Constructing and modifying turnouts, station L-300 to station 4535, Delta-Mendota Canal.	Artis and Griffin, Inc., Bakersfield, Calif.	
200C-193	do	Mar. 19	Constructing cross fences, gates, guard posts, Delta-Mendota Canal.	H. Sykes, Patterson, Calif.	
601C-21	Shoshone, Wyo.	Mar. 7	Buried asphaltic membrane lining, Heart Mountain Canal, station 1332+67 to 1376+45.	Long Construction Co., Inc., Billings, Mont.	
701S-234	Missouri River Basin, Kans.	Mar. 21	Aerial and topographic mapping of reservoir and project lands.	Ryell Engineering Co., Little Rock, Ark.	

Construction and Materials for Which Bids Will Be Requested by July 1952

Project	Description of work or material
Cachuma, Calif.	Construction of 18- by 65-foot concrete Lauro control house and a open 140- by 34-foot concrete pit for control valves; and installation of chlorinating equipment, 36-inch and 48-inch steel pipe, valves, and meters, and 500 feet of 154-inch diameter buried steel pipe for Lauro dam outlet works.
Central Valley, Calif.	Construction of about 14 miles of 340 to 278 cfs capacity main lateral and 20 miles of 85 to 15 cfs capacity sublaterals, near Madera, Calif. All laterals will be earth lined, vary in bottom width from 6 to 20 feet and require appurtenant reinforced concrete structures consisting of drops, checks, road crossings, timber bridges, siphons, and turnouts.
Central Valley, Calif.	Constructing radio reporting rain and snow gages in [...] Central Valley drainage area.
Do	Subsurface exploration of Tehama-Colusa Canal.
Colorado-Big Thompson, Colo.	Salida and Gunnison substations located near Sal[...] Gunnison, Colo., require constructing concrete foun[...] erecting steel structures, installing 115-kilovolts s[...] equipment at Salida substation and electrical equ[...] including one 5,000-kilovolt-ampere, 3-phase tra[...] bank with load ratio control and one 750-kilovolt[...] 3-phase transformer at Gunnison substation. Con[...] of a concrete block shop-garage building at Gunnison[...]

Construction and Materials for which Bids Will Be Requested by July 1952—(Continued)

Project	Description of work or material
ado-Big pson, Colo.	Construction of a temporary switchyard; dismantling of existing wood structures and replacing with steel structures; and reinstallation of electrical equipment, near Kremmling, Colo.
Do	Conversion from 69- to 115-kilovolt construction and addition of overhead ground wire to the Brush-Yuma-Wray transmission line. Present structure spacing is for 115-kilovolt transmission.
Do	Local control, supervisory control, and telemetering equipment for Pole Hill power plant.
rado River ont Work l Levee stem, Nev.-lif.-Ariz.	Construction of protective works for wild game refuge along Colorado River near Needles, Calif.
mbia Ba-, Wash.	Installation of two 65,000-horsepower, 720,000-gallons-per-minute pumps for Units P5 and P6 in Grand Coulee pumping plant; installation of plumbing fixtures, miscellaneous metalwork, including doors, louvers, handrailing, ladders, grating, and covers; and related electrical installation in Grand Coulee dam, pumping plant, and power plant.
Do	Construction of about 8 miles of 13.2-kilovolt, 3-phase, wood-pole transmission line between Bonneville Power Administration's Ringold substation and Ringold pumping plant, and plants at laterals PE47R and PE51 on Potholes East Canal.
Do	Construction of about 3 miles of 13.2-kilovolt, 3-phase, wood-pole transmission line between Bonneville Power Administration's Quincy substation and Babcock pumping plant, West canal lateral W35.9.
is Dam, iz.-Nev.	Erecting steel structures, installing electrical equipment, and constructing control house at Prescott substation near Prescott, Ariz.
Do	Three 161-kilovolt disconnecting switches for Buckeye substation.
Do	Five 115-kilovolt oil circuit breakers and fourteen 115-kilovolt disconnecting switches for Oracle substation.
Do	One 8,000/10,000-kilovolt-ampere unit substation and one 115-kilovolt disconnecting switch for ED-4 substation.
Do	One 8,000/10,000-kilovolt-ampere unit substation and one 115-kilovolt disconnecting switch for Maricopa substation.
, Wyo	Construction of Little Sandy diversion dam on Little Sandy Creek 40 miles above confluence with Big Sandy Creek near Farson, Wyo. The dam includes a 70-foot long, 4-foot high rock weir, 225 feet of earth dike, 0.5 mile of 150 cubic feet per second canal, and canal headworks structure.
utna, Alas-	Two transformer and two governor and lubricating oil storage tanks for Eklutna power plant.
Do	Two generator protective equipment cubicles, including lightning arresters and capacitors, for surge protection at Eklutna power plant.
Do	One 6.6 delta to 12.47-kilovolt grounded wye, 750-kilovolt-ampere power transformer for Eklutna power plant.
d Valley, lo.	Construction of concrete cutoff and rock chute at Badger Wash, Book Cliffs soil and moisture conservation area, 20 miles northwest of Grand Junction, Colo.
Missouri River Basin, Nebr.	Construction of 7,500-kilovolt-ampere Ogallala substation requires concrete foundations; erection of all structural steel; installation and connection of all electrical equipment furnished by the government; and erection of a 16- by 20-foot control house. The substation is to have one 7,500-kilovolt-ampere, 3-phase transformer, one 115-kilovolt bay, and three 34.5-kilovolt bays.
Do	Construction of 10,000-kilovolt Chadron substation requires concrete foundations; erection of all structural steel; installation and connection of all electrical equipment furnished by the government. The substation is to have three 3,333-kilovolt-ampere transformers, one 115-kilovolt bay, and two 34.5-kilovolt bays.
Missouri River Basin, N. Dak.	Construction of three Central North Dakota radio stations for the operation and maintenance of power facilities soon to be placed in full operation.
Missouri River Basin, Wyo.	Construction of about 3,500 feet of 34.5-kilovolt, 3-phase, single circuit and 4.16-kilovolt, 3-phase, double circuit, 60-cycle, wood-pole transmission line from switchyard at Boysen power plant to the vicinity of the existing construction substation, and about 1,000 feet of 34.5-kilovolt single circuit river crossing in the vicinity of Boysen dam.
Parker Dam Power, Ariz.-Calif.	Construction of four-room school building, 4,500 square feet in area, at Parker Dam Government camp.
Riverton, Wyo.	Construction of a permanent check near Wyoming tunnel, construction of Wyoming lateral structures and Cottonwood drains.
San Diego Aqueduct, Calif.	The San Diego aqueduct's second pipe line is to be parallel to the present aqueduct between San Jacinto regulating reservoir, near Hemet, Calif., and the San Vicente reservoir near San Diego. This contract for the northern 31 miles of 95 cfs capacity line requires furnishing and laying 9 miles of 75-inch diameter, 14.4 miles of 60-inch diameter, and 8.5 miles of 48-inch diameter precast, concrete pressure pipe, and constructing vent structures, manhole, and blowoff structures. The 75-inch diameter pipe is to be non-cylinder, and the 60- and 48-inch, non-cylinder and cylinder.

OUR BACK COVER and the maps on pages 101 and 106 are based upon a photograph of a relief model of the United States by Raisz and Brown, reproduced with the permission of the copyright owners, Kittredge and Coolidge.

United States Department of the Interior, Oscar L. Chapman, Secretary

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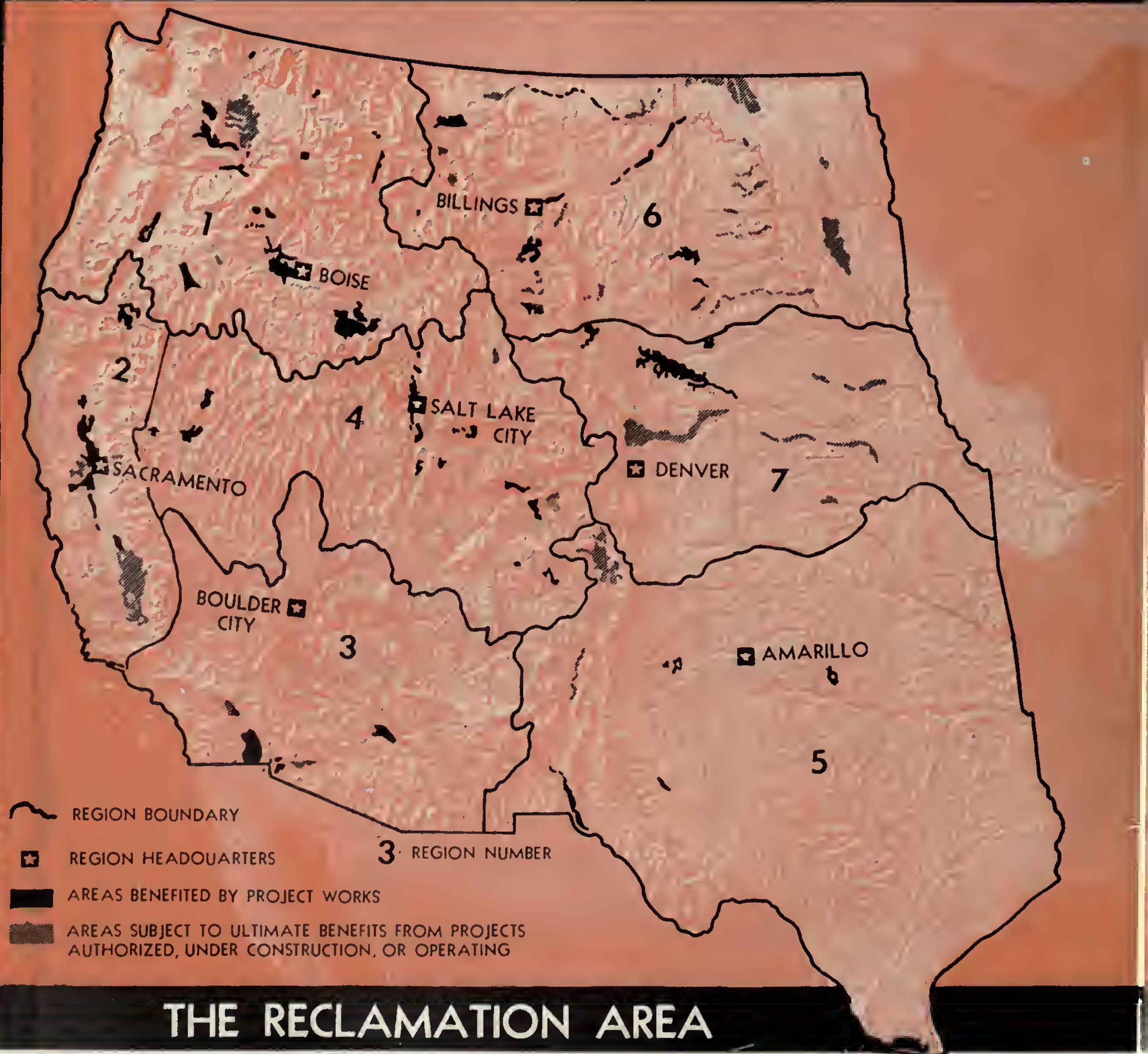

THE RECLAMATION AREA

The Reclamation ERA

June

1952

Reclamation's Golden Jubilee 1902-1952

Official Publication of the Bureau of Reclamation

The Reclamation ERA

June 1952
Volume 38, No. 6

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The printing of this publication has been approved by the Director of the Bureau of the Budget, May 25, 1950.

CONTENTS

FEATURE ARTICLES

SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1.50 a year for persons residing in the United States and Canada; $2 a year for foreign subscriptions; special rate of $1 a year for members of water users' associations, and Bureau of Reclamation employees. No stamps, please!

OUR FRONT COVER

Reclamation's Golden Jubilee

June 17, 1902, to June 17, 1952

FIFTY YEARS AGO, the then President of the United States of America, Theodore Roosevelt, signed the Reclamation Act of June 17, 1902. So far as we can determine, there were no photographs of President Roosevelt actually signing the act. The photo on the cover was, however, taken in 1902—the occasion was the signing of the Thanksgiving proclamation, appropriate enough in spirit for the many celebrations now in progress by westerners benefited through the developments of the past 50 years. The Grand Coulee commemorative stamp went on sale on May 15, 1952, as part of the Columbia Basin celebration of Reclamation's Golden Jubilee Year.

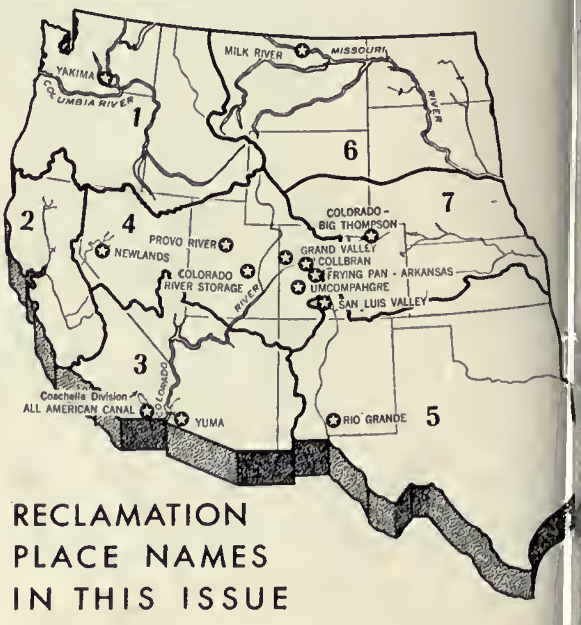
35 YEARS AGO IN THE ERA

MORE FOOD FOR OUR ALLIES

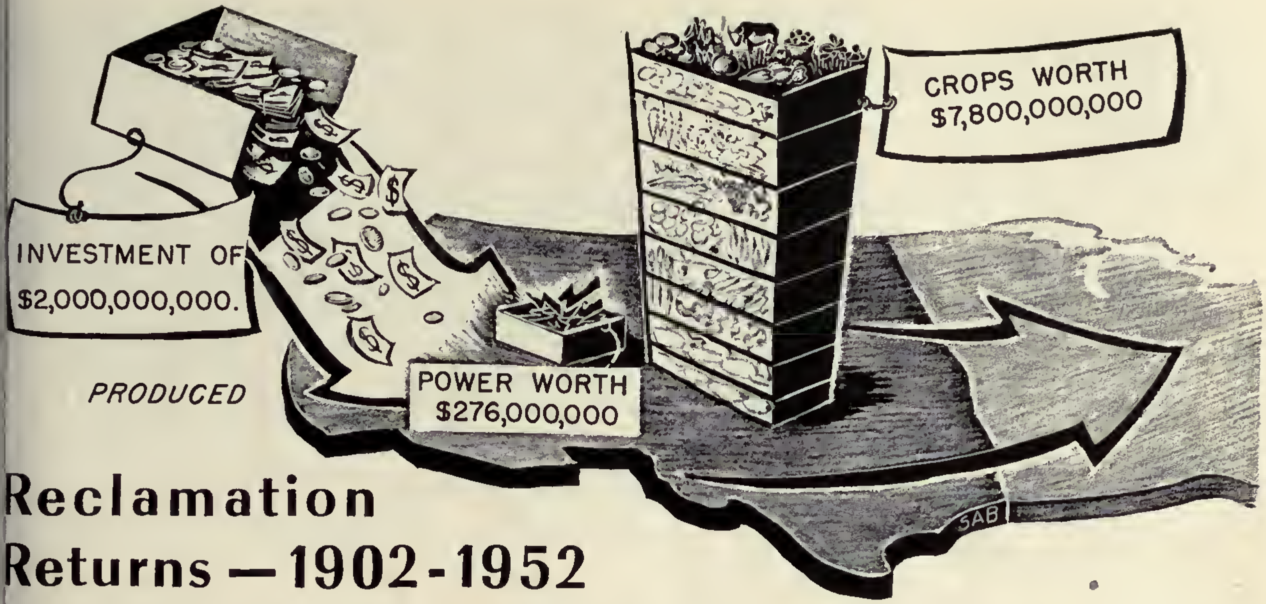
America's first great duty in the present conflict is to help feed her allies. The devastation of war has coincided with a period of low crop production the world over due to natural causes. Serious shortages exist or are threatened.

Now is the time for the Government reclamation projects to justify themselves. What matters a few dollars in costs here and there if a million otherwise barren acres are brought into active service against the terrible submarine; if 10,000,000 bushels of grain, 2,000,000 tons of forage, and 4,000,000 bushels of vegetables are added to the channels of food supply from newly created sources?

(From page 258 of the June 1917 issue of the Reclamation Record, predecessor to the Reclamation Era.)



RECLAMATION PLACE NAMES IN THIS ISSUE



Reclamation Returns—1902-1952

A Report to the Stockholders
on a Fifty-Year Investment

On June 17, 1902, fifty years ago, President Theodore Roosevelt signed the Reclamation Act, and the people of the United States and their Government embarked on a partnership venture for "the development of waters for the reclamation of arid and semiarid lands" in the West.

Under the initial Reclamation Act, a Reclamation Fund was set up to finance the necessary construction and operation of these water resource development projects, using the receipts from the sale and disposal of public lands. In later years, other funds have been invested, until in Reclamation's Golden Jubilee Year 1952, the Reclamation investment amounts to a little over 2 billion dollars.

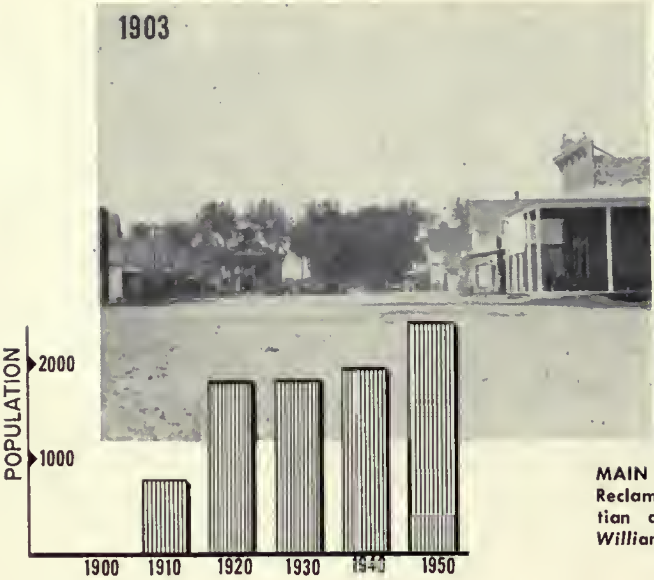
In this, and subsequent issues of the Reclamation Era throughout the Golden Jubilee Year, we shall report how this investment has turned out. "The people interested are entitled to know the facts," said the late Senator Thomas H. Carter of Montana, Chairman of the United States Senate Committee on Irrigation and Reclamation of Arid Lands, on March 3, 1911. With this thought in mind, we report the following status of the Reclamation investment as of June 1952.

After half a century of teamwork in handling western water resources, the people of the West have raised 7.8 billion dollars worth of food and fiber on projects served by water provided through the Reclamation program. Since March 1906 when the first hydroelectric power was generated on a Reclamation project at a temporary plant on Arizona's Salt River project, 276,706,000 dollars worth of hydroelectric power has been produced at plants built and operated by the Bureau.

Federal taxes paid by the beneficiaries of Reclamation projects are now estimated to aggregate over 2.5 billion dollars—more than the combined construction costs for all Reclamation features, which include more than 125,000 family-sized farms representing more than 6¼ million irrigable acres to which either supplemental or full water service has been extended though Bureau-built works.

The first five projects were authorized in March 1903, less than a year after the Reclamation Act was signed. These were the Salt River project in Arizona; the Truckee-Carson project in Nevada; the Uncompahgre project in Colorado; the North Platte project in Nebraska and Wyoming, and the Milk River project in Montana.

Fittingly, on the next page, we inaugurate our Golden Jubilee year with a report on the first Reclamation project to receive water as a result of Federal participation in western water resource development.



MAIN STREET—FALLON, NEV., as it appeared in 1903, 1 year after the Reclamation Act was signed, and as it appears after 47 years of irrigation development. *Both photos submitted through the courtesy of Williams-McNish, Fallon, Nev., photographers.*

NEWLANDS—First in Service

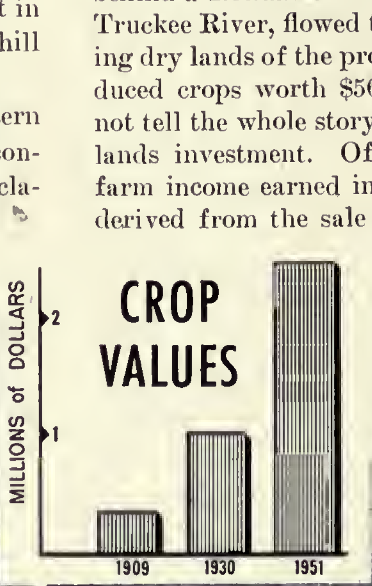
MORE THAN 5 MILLION DOLLARS A YEAR—from a desert area once completely barren and considered absolutely worthless.

Not a gold strike, nor an oil boom. Farmers and ranchers on the Newlands (formerly Truckee-Carson) project in Nevada earned that amount in 1950, according to the Fallon Standard, Churchill County Nevada's weekly newspaper.

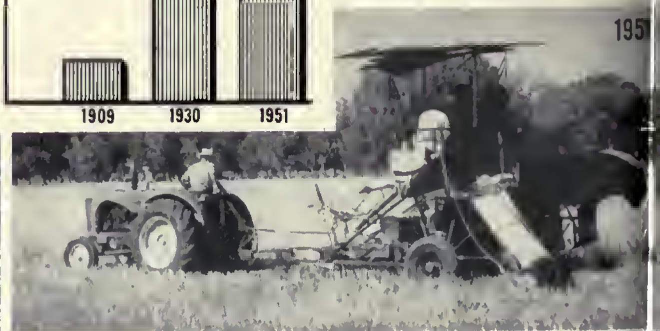
They tapped water—the first to flow on western lands as a result of Government investment, construction, and participation in the Federal Reclamation program.

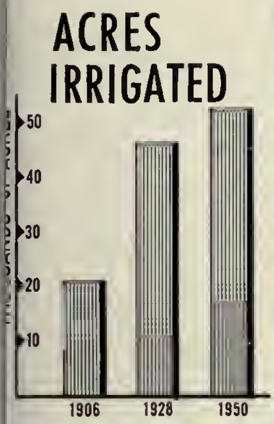
In 1919, this project, first called Truckee-Carson, was renamed Newlands, in honor of the late Senator Francis G. Newlands of Nevada, known as the father of the act which made the project possible.

Since April 1905 when the first water, caught behind a Reclamation-built diversion dam on the Truckee River, flowed through canals to the waiting dry lands of the project, water users have produced crops worth $56,845,526. Crops alone do not tell the whole story of the return on the Newlands investment. Of the 5 million dollars of farm income earned in 1950, only $2,053,000 was derived from the sale of crops. The remainder



WORTH $335,000 according to the first crop report in 1909; 21 years later crops were valued at $1,000,900, and 42 years later $2,456,000. At left, harvesting sugar beets on the Wheeler homestead in 1912 or 1913. Below, harvesting oats at J. A. Williams Ranch (Photo by Williams-McNish





ıme from the sale of livestock and livestock roducts. In other words, for every dollar's orth of crops, Newlands project farmers and anchers earn almost a dollar and a half from their airy and beef cattle, sheep, hogs, poultry, milk, utter, and eggs.

Livestock from many western ranches is shipped o Newlands to be topped off on the rich, green lfalfa and other feed and pasture of the project. 'he project is the most productive area of 'hurchill County, ideal for livestock raising, due the mild winters, year-round pasture and tuberulosis-free climate.

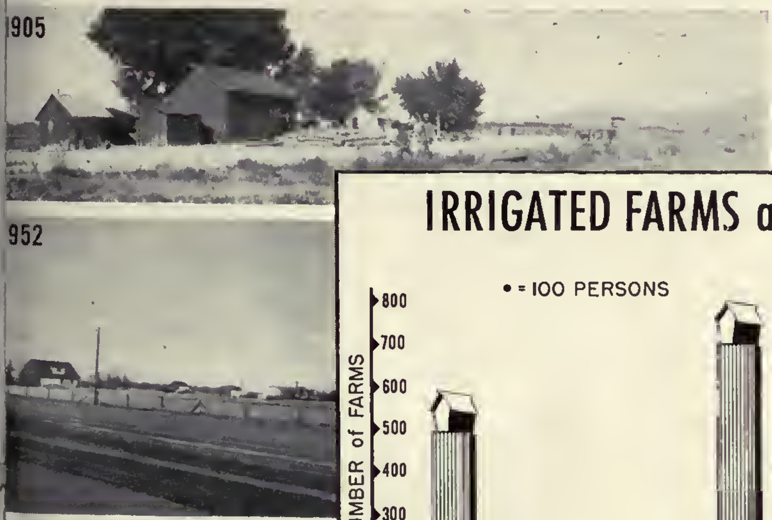
Water users of the Newlands project have also aid direct to the Government, in cash, more than hree-fourths of the amount charged them for Reclamation construction in accordance with

CONCRETE REPLACED WOODEN STRUCTURES. The number of irrigated acres increased from 20,784 in 1906, to 46,085 in 1928 and 58,893 in 1950. At left the old wooden chute from Truckee Canal *(photo by S. R. Marean)*. Inset, Lahontan Dam and Power Plant. *Photo by H. Smith Richards, Region 4 engineer.*

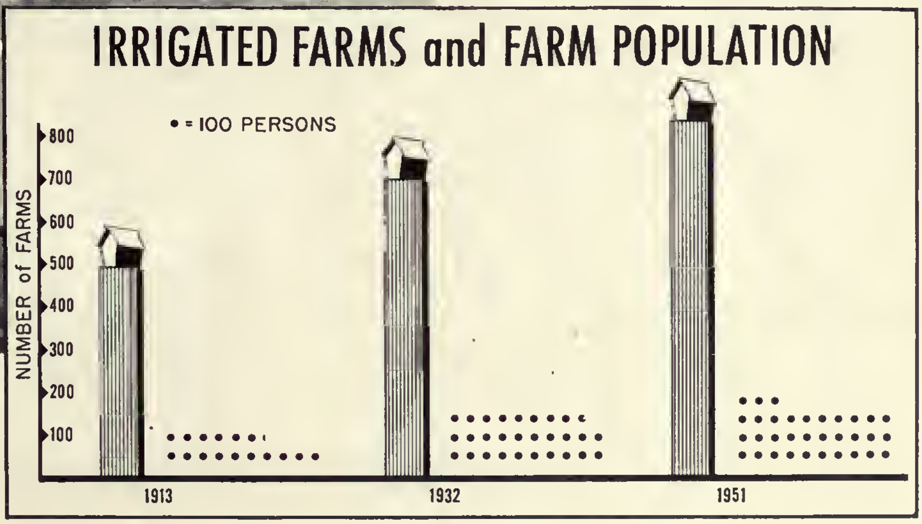
Reclamation Law. They have never been behind on their installments of the $3,281,999.35 reimbursable cost. In actual figures they have repaid $2,478,893.07.

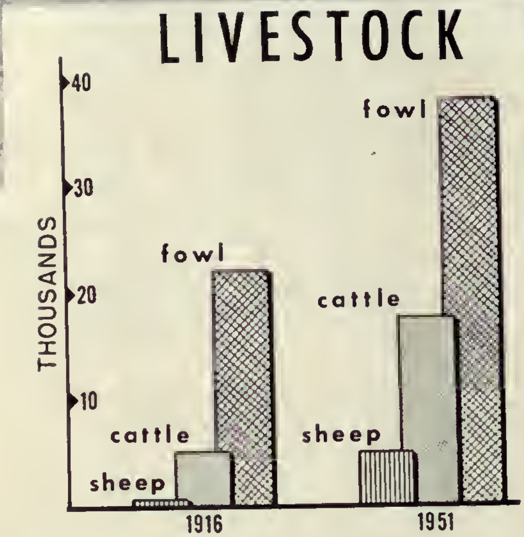
In 1927 the Truckee-Carson Irrigation District, then being financially and technically qualified to operate and maintain the project, took over the works. Today, the Bureau of Reclamation serves as a legal, technological, and financial adviser, standing by to render assistance when necessary.

In dollars and cents, Newlands can be considered a sound investment. As a pioneer project, it also paid off in "know-how," as lessons learned at New-



FAMILY-SIZED FARMS—In 1913, only 494 farms and 1,635 people on the project. By 1932, 700 farms and 2,883 people, and in 1951 about 3,300 people and 838 farms. The Old Oar Ranch near Leeteville about 1905, and the same place (now the Ken L. Ogden Ranch) today.





THE BIG SUCCESS STORY AT NEWLANDS—The first livestock census to include dairy and beef cattle in 1916, shows 4,633 cattle, 191 sheep and 22,024 fowl and turkeys; for 1951, 17,668 cattle, 4,968 sheep and 37,864 fowl and turkeys. ***Early scene at Thomas Dolf Ranch photographed by S. R. Marean. Newlands feed yard in 1951 photographed by Williams-McNish.***

lands and other early projects benefited many projects which followed.

A man who ought to know, Stanley R. Marean, who served Reclamation so well for 26 years that he was given a Meritorious Service Award in 1949, points out that the Newlands project had all of the problems encountered by most of the other early Reclamation ventures. Marean moved to Fallon and began working on the project on April 10, 1906. He was the first full-time watermaster in 1907, and when the Government turned the project over to the water users in 1927 he worked for them as hydrographer, watermaster, and general trouble shooter until 1934. After working on the Humboldt, Nev., and Minidoka, Idaho, projects, he retired voluntarily in 1949 and now lives in Reno, Nev. Marean explains that the early project leaders bumped into many problems without the benefit of previous experience, but overcame most of the major ones.

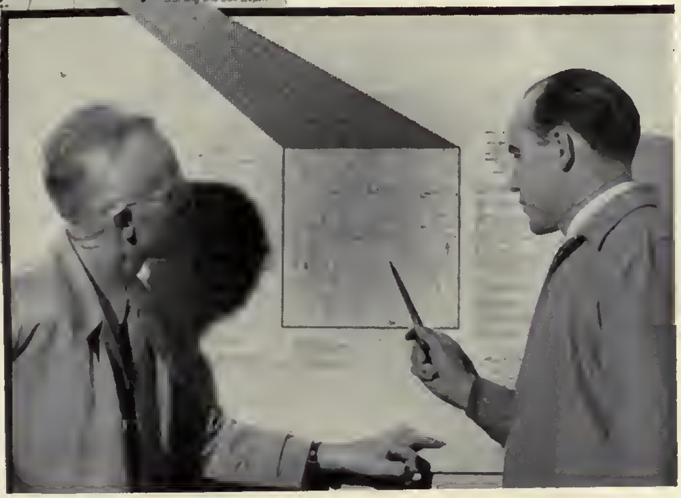
Public lands in the Truckee and Carson River watersheds were withdrawn from all forms of public entry immediately after the Reclamation Act was passed in 1902 thus preventing speculation on land grants. However, as on most other projects at that time, homesteaders could purchase the right to gain title on from 40 to 160 acres of land for a filing fee of from $8 to $32. No previous farming experience, cash reserves, livestock, or equipment were necessary. As a result of the experience gained from the bitter disappointments in the Newlands and other early projects, Reclamation Law has been amended so that those who embark upon the adventure of transforming raw desert or sagebrush land into productive family sized farms have the necessary prerequisites for success: farming experience, and enough cash to get off to a good start. In certain cases, some of the assets may be in livestock and equipment useful in developing an irrigated farm.

The new settlers were eager to get the new land into production, and stripped huge areas of its desert vegetation. The lands became seriously eroded. Some parts of the project resembled a dust-bowl. Farmers often had to replant crops three or four times in a season and ditches were sometimes blown full of sand overnight. Careful land preparation and conservation practices have been developed to eliminate such conditions through the years.

Land classification was in its infancy when the Newlands project was being developed. Many farms were abandoned due to the existence of alkali in some areas. Even now, some of the best

(Please turn to page 154)

THEN AND NOW—TEN TO ONE.— *The map at left, made in 1915, covers 10 square miles, and furnishes information only on the soils in the area. Below, the authors (Poulson at left, Swarner at right) look at a modern land classification map on which detailed information on one square mile is charted. Photo by Phil Merritt, Region 1 photographer. Map from the Special Report on the Silver Lake project, Lahontan Basin, by the Reclamation Service in 1915.*



THE EVOLUTION OF LAND CLASSIFICATION

By E. N. POULSON, Soil Scientist, and L. R. SWARNER, Irrigation Engineer, Boise, Idaho, Region 1

Part five in a series of articles on soils and land classification

What can the land produce? This question has always been the chief concern of man. Even as a hunter and nomad, we suspect, long before he began to domesticate animals and till the soil, he had his difficulties in correctly evaluating land resources. But no doubt his headaches became more acute and lasting as he gave up or was forced to give up his more nomadic life in quest of game, fruits, and seeds and began planting crops, becoming more directly dependent on the soil for his livelihood. From observation he probably had gained a good knowledge of where natural vegetation thrived and game was most abundant. Such sites were natural settings for his home and his cultivated crops. In time, as his family tree expanded and his holdings grew, he learned the broad uses of the better soils and the limitations of the inferior ones. Thus in this primitive environment began the first inventory of soil resources, a practice which still continues and which, with its more sophisticated scientific terminology and techniques, is known as land classification.

The pioneers who first gazed upon the high mountains, the vast plains and valleys of the West were guided in their land selection by the undisturbed trees of the mountains and valleys, the ungrazed, unplowed grasslands of the plains, and the sparse shrubs of the desert, but few scrutinized the characteristics of the soils supporting this growth. As early as 1861 the Mormons, who pioneered in irrigation in the West, sent a party from Salt Lake City into the Uintah Basin to determine the feasibility and desirability of irrigating those lands. The contrast between this area and the fertile valleys that they were already farming led them to discourage development of the new section.

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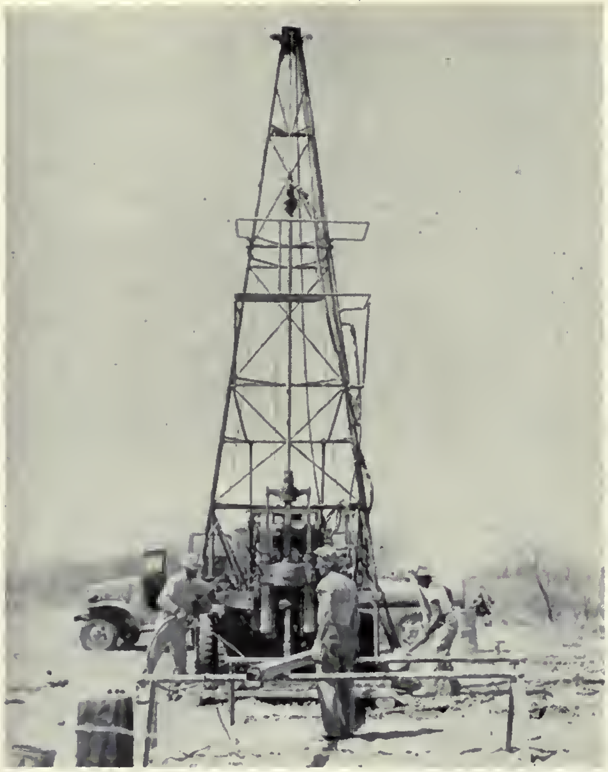


THE PROBE—*At top, the hydraulic rotary drill and coring rig used to extract samples and dig observation wells at 42 sites in Coachella. Below, a Coachella Valley County Water District employee installs a piezometer by means of the jetting process. Top photo submitted through the courtesy of the United States Salinity Laboratory, Riverside, Calif.*

Coachella Drainage Investigations

Part 2

Investigating the Underground

by J. S. REGER, Hydraulic Engineer, Region 3

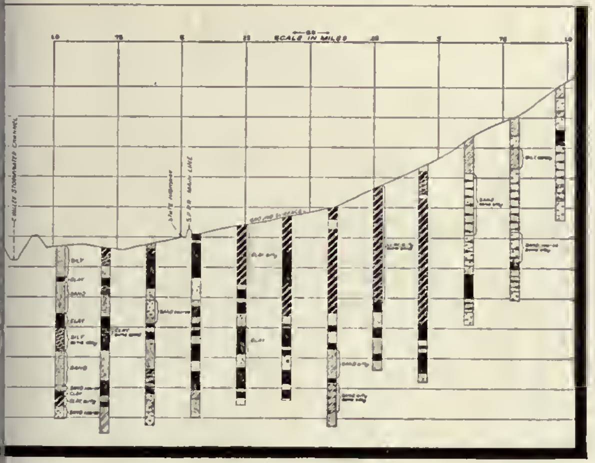
> EDITOR'S NOTE: In part one of this series, the people of the valuable Coachella Valley, who had been pumping water from a dwindling underground water supply, are about to receive an additional supply carried from the Colorado River through the Coachella Branch of the All-American Canal and piped to 78,500 acres in the Coachella Valley. Mindful of the dangers of waterlogging, they form a four-way organization known as the Coachella Valley Cooperative Drainage Investigations in 1945 to prevent and combat future drainage difficulties.

INFORMATION ON THE UNDERGROUND WATER in th Coachella Valley is not too easy to get.

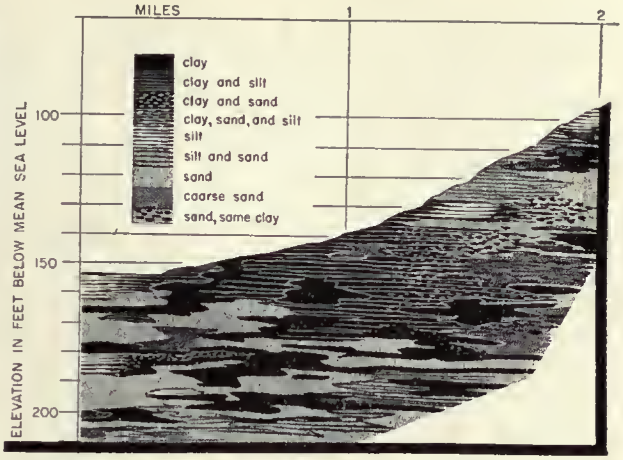
Drainage investigations are not new to the val ley, but the idea of starting a drainage investiga tion before the problem becomes acute is almost, i not entirely, unique in the history of irrigation i the Western States.

The first job of the investigators was to find ou what the underground floor of the valley looke like, and where the water was. There were n adequate data on the materials underlying th valley, the location and extent of all ground wate bodies, the type of water body, position and slop of the water table, variations in pressure head seasonal fluctuations of the water table an ground-water quality.

From what they knew about the characteristi of the Coachella Valley, the investigators decide that nothing short of a detailed study of all phys cal conditions affecting drainage would do the jo Millions of years ago the area had been tossed an turned, flooded and burned dry. After the valle had settled down, the winds blew for centurie lakes and rivers came and went. Like other dese fill areas, the strata are very irregular in distrib



IE LOGS—A typical profile of logs obtained by the jetting rig Coachella, showing variations in strata.



THE UNDERGROUND—A typical cross-section of the Coachella Valley. ***Drawing by Shirley Briggs, Washington, D. C.***

on and thickness, similar to glacial drift. The nderground could not be charted like areas with different geological history, where the strata lie more or less orderly layers.

After studying all the data and information ailable, the technicians on the drainage investi-ating committee decided to sink some small ob-rvation wells in strategic spots in an attempt to robe the underground and force it to give up some f its secrets. They carefully located 42 sites long a 2-mile "grid" (or charted area) and with e aid of a hydraulic rotary drilling rig supplied y the Bureau of Reclamation, started drilling the ells in March 1948. Three employees of the oachella Valley Water District and a four-man ew and driller from the Bureau drilled, cored d completed the 42 wells in 43 working days. he holes were 6 inches in diameter, averaging 80 et deep, although depths varied from 40 to 110 et below the surface. As each hole was drilled, core-barrel attachment removed cylinders of the bsurface material, each one a sample of the con-ition of the underground as far down as the well enetrated. A 2-inch inside diameter casing, or ipe, perforated with ¼-inch holes at the lower feet, and in some cases the lower 10 feet, was in-rted in each drilled hole and packed with gravel r the entire depth.

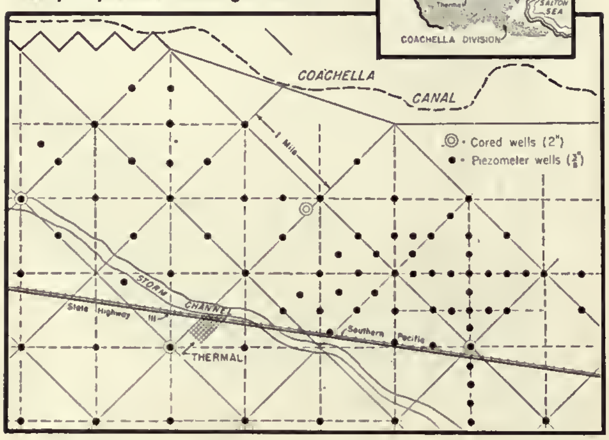
The 600 or so samples taken from the drill holes ere analyzed and a sample log, or description of ch well supplementing the notes taken by the riller, was added to the information available to e investigating committee. By June 1948 the rst ground water observations had been obtained om these wells.

As had been suspected, there was no uniformity, or shred of similarity between the situations unearthed by any of the wells. Underground conditions might be entirely different 100 feet away from a well in any direction. The investigators would need hundreds of wells of varying depths to get enough information to help solve the problem.

Any known method of drilling such a large number of observation wells would be too expensive, even for the worth-while purposes of the investigations. The cooperating engineers, however, remembered using piezometers, slim (three-eighths inch in diameter) jetted self-casing wells for groundwater obvervations. As the only drawback was the lack of a portable rig for large scale operations, the engineers got together, and designed and constructed a light weight, mobile rig by the summer of 1948. Those who are interested in the technical details of this operation are referred to the article entitled, "Techniques for Drainage Investigations in Coachella Valley, Calif.," by J. S. Reger, resident drainage engineer of the investigation; A. F. Pillsbury, associate professor of irrigation, University of California; and R. C. Reeve and R. K. Petersen, associate agricultural engineers, Regional Salinity and Rubidoux Laboratories, U. S. Department of Agriculture, in Agricultural Engineering, Vol. 31, No. 11, pp. 559–564, November 1950.

The rig, which includes a water tank and pump to supply the jetting pressure, is towed by a specially equipped four-wheel-drive truck—a necessity for traveling over the seemingly impossible desert terrain.

THE GRID—At right, shaded area now plotted on network. Below, closeup of predetermined grid section.



The jetting method of drilling and casing small diameter observation wells is simple and inexpensive. New techniques developed during the course of the Coachella Investigations have overcome many former obstacles and have resulted in several improvements in the jetting method.

Two men can operate the easy-to-handle jetting operation. They attach the 3/8-inch pipes, or piezometers, to the water tank hose, set the pipe upright on the designated well-site, turn on the water pressure, and as one man takes his notebook or drilling log and jots down a report on the oozed-out substrata as the piezometer drills downward, another uses the operating handle to force the pipe through tough materials which otherwise might not be penetrated. Believe it or not, this operating handle also aids the driller in logging the materials encountered—an experienced operator can tell by the "feel" of the handle whether the piezometer is jetting through silt, clay or sand, and whether it is coarse or silty. An innovation by the cooperating engineers at Coachella is a "self-measuring" device—a revolving tape which measures the depth below the surface to which the drill pipe has penetrated, making it possible to record changes in the underground strata within about an inch—or one-tenth of a foot. They also "grease" the pipe with a commercial drilling "mud" which helps to penetrate coarse materials and keep the drilling water flowing evenly to the surface along with the "effluent" or ejected material. Thus the jetted piezometers, as they are installed, furnish valuable and necessary information on the subsurface conditions which have so much to do with the way the water behaves under the surface. They continue their usefulness by remaining in place as multiple-purpose ground water observation wells.

The investigators left nothing to chance. They tested this newly acquired substrata detecting ability of the piezometers by training a two-man crew, familiar with the method of drilling wells by the jetting process, in methods of accurately logging the encountered subsurface material. Here again, the importance of planning a program paid off in dollars and cents. Without their knowledge, the two crew members were subjected to a test probably unheard of in drainage engineering research. They were sent to drill wells, by means of jetting process, at locations within 10 feet or less of the larger wells which had been drilled and cored by means of the hydraulic rotary drilling rig. The crew spent months of hard work in the field, often during summer temperatures exceeding 120°. When their drill logs and field estimates were compared with the laboratory analyses of the core samples from the first 42 rotary-drilled wells, the investigators were satisfied that the jetting process of drilling wells was accurate enough for detailed drainage investigation purposes.

(Next Month—Using the Evidence)

Dana Templin Passes

Dana Templin, veteran Reclamationist and former Superintendent of the Minidoka project, Idaho, passed away on July 29, 1951. Mr. Templin joined the Bureau of Reclamation as a Junior Engineer at Burley, Idaho, then headquarters of the Minidoka project, in 1908. He worked on this project continuously until his retirement in 1939, probably a record for length of service by a Bureau employee on a single project.

Mr. Templin was a native of Kokomo, Ind., and received his degree in Civil Engineering from the University of Kansas in 1893. He is survived by two sons, Neal S., and Ernest H., and a grandson.

OUR BACK COVER is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners, Kittredge and Coolidge.

EARLY-DAY PIONEERS' descendants dedicate the oldest continuously used ditch in Colorado. At left, A. J. Hamman of Colorado A&M College; Delfino Salazar, direct descendant of one of original locators of ditch; Dr. Charles A. Lory and Dr. William E. Morgan, President Emeritus and President, respectively, of Colorado A&M. (Note old plow and yoke used to dig first ditch.)

COLORADO'S 100 YEARS OF IRRIGATION

by CLIFFORD H. STONE

irector of the Colorado Water Conservation Board

Denver, Colorado

Colorado's Irrigation Centennial was ob- erved on April 8, 9, and 10, 1952.

A monument, carrying an appropriate plaque, as placed at the headgate of the San Luis Peo- le's Ditch in the San Luis Valley. This ditch as a priority date, the oldest in Colorado, of pril 10, 1852, and it has been in continuous use nce that time.

With the exception of one farm, all of the land rigated by this ditch is now operated by direct escendents of the men who built it 100 years ago. he Spaniards who located this ditch brought ith them the legal concept of the appropriation f water for agricultural purposes in arid regions. his influence, together with other factors, gave irth in Colorado to the priority of appropriation octrine of water law. They, and settlers in other arts of the State, initiated a system of water law hich is now expressed in the constitution and tatutes of the State.

The John Hatcher Ditch on the Purgatoire River, a tributary of the Arkansas River, was constructed in 1846, but, because of the troubles which these early irrigators had with the Indians, it was only intermittently used prior to the early 1860's. Other water diversions from the Arkansas River in Colorado were made near Fort Bent in 1832, but were used only a few years. In 1841 water was diverted from the Arkansas River for irrigation of land near the present site of Pueblo, Colo. These diversions were abandoned in 1854.

These earliest irrigators, and those who came to Colorado during the next three decades, were able to construct by individual effort the ditches which were the least expensive and easiest to build. Then came a period when farmers banded together through associations and ditch companies to construct larger structures, the cost of which was beyond the financial ability of individual farmers. During this latter period irrigation had its greatest expansion in Colorado.

The Federal Reclamation Act of 1902 initiated the present era of water development in Colorado. This era typifies a third period when it is recog-

PRESENT-DAY PROJECTS in Colorado. Above, irrigated orchards of the Grand Valley project. At upper right, Vallecito Dam and Reservoir of Pine River project. At lower right, modern headworks of the Rio Grande Canal, San Luis Valley, with its electrically operated, automatically controlled gates. Nine Reclamation projects have been or are being built in Colorado.

nized that material irrigation expansion in the West can be accomplished only through Federal financing. Also, in this period when the final pattern of basin-wide development is being cut, it is necessary to recognize the interest of the Federal Government in water utilization and control. At the same time it is understood that the integrity of State water law and the rights and interests of the States in such development shall be preserved.

During the 100 years since the San Luis People's Ditch was built, irrigated acreage in Colorado was expanded from a few hundred acres to the third largest found in any Western State—about 3 million acres in 1950.

An indication of the economic value of agriculture in Colorado is shown by the 1950 estimate of the cash income from farm marketings for the State in 1949. This estimate shows gross crop sales of $245,286,000. This figure includes returns from crops raised on dry land, but it must be noted that the returns from dry lands fluctuate greatly from year to year, depending upon rainfall, whereas, the production from irrigated land in the State is fairly constant. In any year, irrigated land production in the State is far in excess of that from dry lands. Agriculture in Colorado is closely allied with livestock production. In addition to crop returns, the cash income in Colorado from livestock and livestock products in 1949 was estimated at $280,847,000.

During the first 35 years of the Federal Reclamation program (1902 to 1937), only two Federal water development projects were constructed in Colorado: Uncompahgre, authorized in 1903, and Grand Valley, started in 1912.

Commencing in 1937, after the creation of the Colorado Water Conservation Board, Federal water development in Colorado has advanced rapidly through the authorization and construction of numerous large and small projects.

Congressional authorization is presently being sought for the Fryingpan-Arkansas project, the Colorado River Storage project and participating projects, the Collbran project, and amended authorization to include additional features for the Paonia project which is partially contructed.

The Colorado River Storage and participating projects will provide for comprehensive development of the Upper Colorado River Basin in the States of Colorado, New Mexico, Utah, and Wyoming. It will make available hold-over storage to enable these States to meet their obligations under the Colorado River Compact for delivery of water at Lee Ferry for use in the Lower Basin and, at the same time, to make full use of the 7,500,000 acre-feet of water a year allocated by the compact to the Upper Colorado River Basin. In addition, this extensive plan of development will include numerous units for the beneficial use of water. This project plan was made possible by the Upper Colorado River Basin Compact which became effective on April 6, 1949.

(Please turn to page 140)

EPHANT BUTTE IN 1946, after the Rio Grande project's ater supply started to decline. *Photo by C. W. Kapus Region 5.*

ELEPHANT BUTTE IN 1951, showing clearly the high-water mark, and the almost nonexistent water supply with which Rio Grande farmers "made do." *Photo by Labon Backer of Region 5.*

Defeating the Rio Grande Drought

by RALPH BRISTOL

egional Operation and Maintenance Supervisor Region 5 headquarters, Amarillo, Tex.

FIFTY YEARS OF SERVICE to users of water made available through the facilities of the Bureau of Reclamation are exemplified by this story of cooperation between the people and their Government. On April 30, 1952, project employees of the Rio Grande were given a Unit Citation for this outstanding public service in harmony with the highest standards and best traditions of the Bureau of Reclamation and the United States Department of the Interior.

IN THE EARLY 1940's the two large storage reser-oirs of the 155,000-acre Rio Grande project in New Mexico and Texas were full and running over. Precious quantities of irrigation water spilled and lowed down the Rio Grande, unneeded and un-sed.

By contrast, last summer thousands of project armers faced imminent disaster. The reservoirs vere virtually dry, and crops valued at millions f dollars were threatened with destruction.

For the first time in the 34 years since the proj-ct was built by the Bureau of Reclamation, water sers faced a ruinous drought.

The outflow of water from storage had been xceeding the inflow for several years.

The inflow had averaged 659,300 acre-feet for he years 1943 through 1950.

Outflow for the same 7 years averaged 791,400 eet annually.

For nine straight years the amount of water entering Elephant Butte Reservoir had been below the all-time average, based on records from 1895 through 1950. This average was 1,075,300 acre-feet.

For hundreds of years, life in the Rio Grande Valley has depended on the river that heads up in Colorado's Rocky Mountains, meanders south through New Mexico and then flows generally southeastward to form the international boundary between the United States and Mexico.

And then, in 1951, the grand old river failed to deliver the one paramount source of all life.

The problem had been several years in the making. The watershed of the river, stretching for hundreds of miles to the Alp-like peaks of the Rockies, had been receiving far less than normal amounts of snow and rain.

Project water users and their neighbors in the towns and cities learned as never before that the river has the power to enrich or impoverish.

To say that the people in the area were worried and concerned about the plight in which the historic Rio Grande had left them is a gross understatement of fact. To say that some persons in the area did not practice intolerance and point accusing fingers would also be an understatement. But in a very large measure, the people who were affected by the failure of the water supply displayed patience, a high sense of honor and a genuine willingness to cooperate with others in finding a solution to the problem.

The story of how the effects of the drought were overcome is one of wise planning, cooperation, and hard work.

The Elephant Butte Irrigation District in New Mexico and the El Paso County Water Improvement District No. 1 in Texas, comprise the Rio Grande project proper. Farther downstream in Texas, the Hudspeth Irrigation District, which irrigates about 18,000 acres, has a Warren Act contract, and obtains water in excess of the Rio Grande project's needs. Last summer, the farmers in this area also faced complete loss of their crops to drought and the scorching sun and winds.

In March 1951, the project's storage reservoirs contained less than 300,000 acre-feet of water—the lowest in project history. No replenishment was in sight. The project needed 730,000 acre-feet for its own use and an additional 60,000 acre-feet for delivery to the Republic of Mexico under treaty agreement.

The project's predicament had not materialized without warning. As a matter of fact, L. R. Fiock, project manager, who had been employed on the project continuously since 1913, and many of the pioneer water users, were familiar with the watershed's long-range weather pattern; they foresaw the approaching shortage as early as 1946. From that time on Mr. Fiock and officials of the two districts had conserved their treasure to th greatest extent possible. They also drew up plan to meet the impending emergency.

When it became painfully apparent that projec farmers would have only half as much water i 1951 as in any previous year, the project manage and the District boards began putting their previ ously planned strategy to work. The basic prob lem called for stretching the available water sup ply as far as possible and doubling its efficiency Farmers cooperated fully. They set aside som fields for fallowing; planted crops which requir a minimum amount of water, and drilled approxi mately 700 wells to supplement surface supplies Irrigation deliveries reduced waste at every point As new problems arose, the water users, thei representatives and project officials met to decid jointly what to do about the mounting crisis. Fo example, one measure employed by the emergenc squad involved the use of project canals and lat erals to convey well water to the fields of farmer who owned the wells and also to the fields o neighbors without ground-water facilities.

With only 50 percent of the usual water supply members of the Elephant Butte and El Paso dis tricts raised 45 million dollars worth of crops i 1951—3 million dollars more than the year before

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100 Years of Colorado Irrigation

(Continued from page 138)

Measured by the size of physical facilities, cost and benefits, the Colorado-Big Thompson Federal Reclamation project overshadows all others which thus far have been undertaken in the State. It is expected this project will be substantially completed in 1953. None is more spectacular in design and plan of operation.

Since the Colorado Irrigation Centennial featured a ditch in the San Luis Valley which has been in continuous operation for one hundred years, it seems appropriate to make special mention of recent project development in that area. The Platoro Dam on the Conejos River was completed last year and will store water in 1952. It is one of two units of the authorized San Luis Valley Reclamation project which will provide irrigation and flood control benefits. The Rio Grande Canal Water Users Association has recently installed, at an approximate cost of $105,000, which was fully paid from its fund whe construction was completed, improved headwork for the Rio Grande Canal. Five electrically op erated and automatically controlled radial gate regulate the depth of the water in the canal withi one-fourth of an inch. The total length of th canal and its laterals is 210 miles and there ar 125,000 acres of land irrigated by it.

The headwaters of four major river basins li in Colorado: the Colorado, the Rio Grande, th Arkansas, and the Platte, tributary to the Mis souri. As a result, water produced in the hig mountains of Colorado flows out in all directio into adjoining States and beyond. For this rea son, Colorado, for many years, has been concerne with programs relating to basin-wide develop ment and the adjustment of interstate water re lations. The State is a signatory to eight inter state water compacts. These compacts, togeth with decrees of the Supreme Court of the Unite States, cover all major rivers of the State an some of their tributaries.

##

HE DITCH DOES IT.—On ne side of the East Main Canal in Yuma Valley, valuable citrus groves. On the nonirrigated side, worthless desert. *Photo by Ben Glaha, Region 2 photographer.*

Yuma, Arizona... ...an investment that makes cents!

LOCAL ACCOMPLISHMENTS OF AN IRRIGATION DEVELOPMENT MEASURED IN TERMS OF NET INCOME

by ROY D. GEAR, Economist, Operation and Maintenance Division, Region 3, Boulder City, Nev.

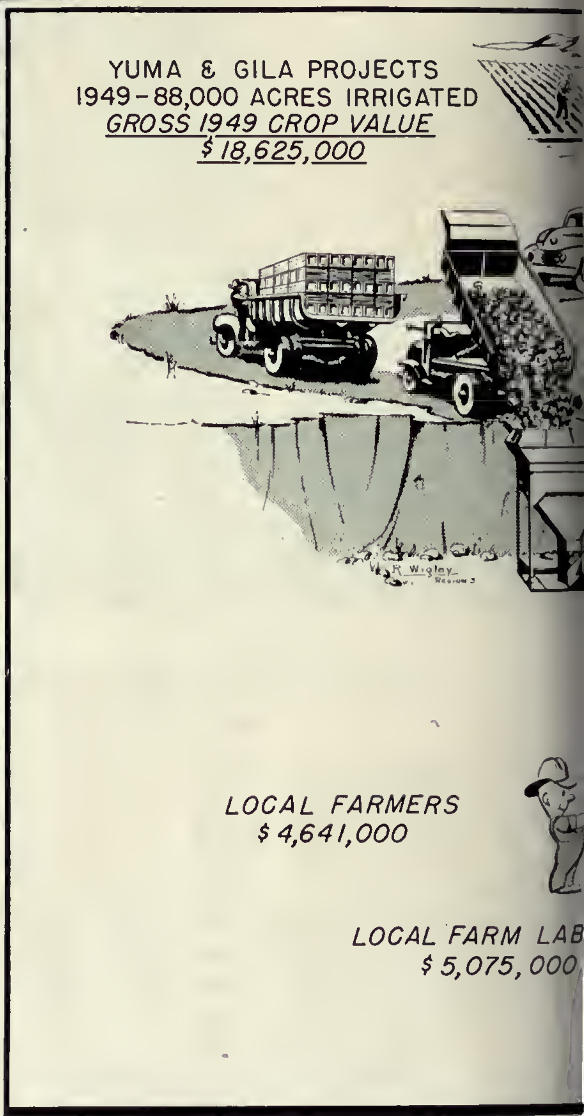
To TRAVELERS CROSSING THE PARCHED DESERT of southwestern Arizona on U. S. Highway 80, the fabulous area served by the Bureau of Reclamation's Yuma and Gila projects comes as a sudden and amazing relief. Here, surrounding the city of Yuma, is a 90,000-acre irrigated paradise that will expand to 185,000 acres within a few years as additional water is made available for development.

The traveler might well say, "Fortunate indeed are these farmers, to reap such a bountiful living from man-made irrigation projects." But something more important which the traveler does not realize is that for every person living on an irrigated farm, seven others maintain a decent standard of living in the surrounding towns.

Agricultural production is made possible by irrigation, as rainfall averages only 3 to 4 inches annually. It is the primary industry responsible for the bulk of the economic activity of the area. Without it, Yuma would be only a maintenance station on the hot, burning desert, serving the Southern Pacific Railroad, the only rail artery through the region, and the highway travelers.

A report just completed by Region 3 of the Bureau of Reclamation, "Evaluation of Local Irrigation Accomplishments, Yuma and Gila Projects' Trade Area," shows that from the gross crop value of $18,625,000 for calendar year 1949 farmers and farm laborers derived $9,716,000 net income. The year 1949 was selected for study because of the availability of census data. Net income to local businesses and nonfarm workers in that year amounted to $16,945,000. This latter figure was due entirely to the irrigation development, since income created from other sources such as tourists, mining, transportation, and pensions, was deducted. In other words, for every $1 of net income received by the basic agricultural industry of the area, an additional net income of $1.74, indirectly attributable to agriculture, accrues to local supporting business establishments and their employees.

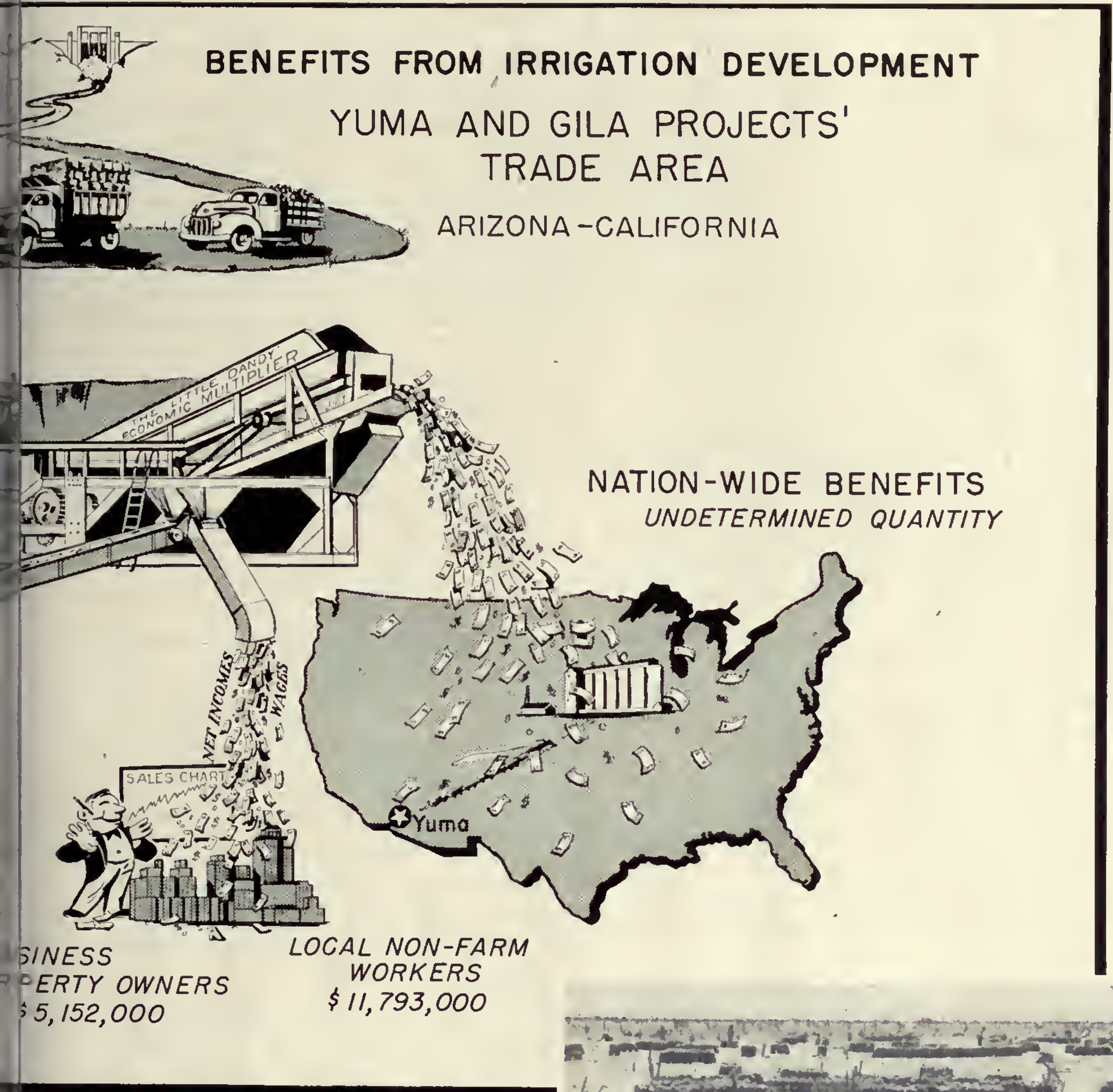
ALONG RECLAMATION ROAD—Fruit and vegetoble at the Yuma Mesa Fruit Grower's Association citrus shed (at left), winter feeding ond lambing for Wyomin at Yuma-Mesa (lower left), picking cantaloupes, ond ing onions in the Yumo Volley (lower right)—all en the "Little Dondy Economic Multiplier" (below).



It must be kept in mind that the foregoing figures represent only the measurable local accomplishments. Benefits from Reclamation extend throughout the Nation, but are difficult to measure dollar-wise. For instance, farm machinery comes from eastern or midwest manufacturers, which in turn depend on submanufacturers and suppliers of raw products. Transportation companies, insurance companies, wholesalers, and financiers also enter into the economic activity connected with getting the machinery from the manufacturer to the ultimate tiller of the land. In the other direction, additional activity is created as farm products leave the local area in freight cars, bound for processors, manufacturers, wholesalers, and retailers. Ultimately, they reach the consumer, sometimes as fresh vegetables for table use in New York, or as oil from the castor bean to lubricate a jet engine in the skies over Korea.

In 1949, the year covered by the study, 20,420 carloads of farm commodities were shipped out of the area. A large share of the shipments consisted of winter and early spring vegetable crops bound for all parts of the United States. The local payroll connected with the icing activities alone amounted to over $100,000, which may be attributed solely to the irrigation development.

Shipment of winter vegetables from the Yuma and Gila projects during the year of study inluded 4,000 carloads of cantaloup, 6,350 carloads f head lettuce, and 3,700 carloads of other vegeables. Over 1,000 cars of citrus fruit also were hipped. Approximately 90 percent of all vegetables shipped from the Yuma area are consumed east of the Rocky Mountains, with a portion going to Canada. Seed crops are marketed throughout the country, but virtually all of the out-shipments



of hay, livestock, grains, and other miscellaneous crops are routed to southern California.

The rail in-shipments from all parts of the United States during the same period for farm supplies, including machinery, fertilizers, insecticides, seed, box shook (crate lumber), and livestock, totaled 1,732 cars, which accounted for only about 50 percent of rail freight unloaded at Yuma. Quantity of truck freight, a highly significant item, was not determined.

Approximately 85 percent of the irrigated area in Yuma County in 1949 was within the Yuma and Gila projects' trade area. It has been estimated that for the same year, the Federal Government reaped a harvest of $6,155,000 in Federal taxes of various kinds from Yuma County. Of this amount, slightly over $1,000,000 was individual income taxes paid by farmers.

The investment of Federal funds required to build the projects is being repaid without interest by the farmers, despite the fact that they receive just slightly in excess of one-third of the local benefits. It might be more fitting were the traveler to say, "Fortunate indeed are these local business operators, to be located within the trade area of an irrigation project."

Other accomplishments of irrigation such as benefits from improved community welfare, stabilization of the regional economy, security of project settlers, and an increased number of opportunities to earn a livelihood were not measured in the Yuma-Gila project study.

The Yuma project is one of the major irrigation developments in the area at the present time with 58,000 acres of land under irrigation. It is one of the oldest Reclamation projects. Water was first delivered in 1907.

The Gila project is one of Reclamation's newest, with approximately 33,000 acres under irrigation last year. With full development, 40,000 acres will be irrigated on the Yuma Mesa Division and 75,000 on the Wellton-Mohawk Division, where Colorado River water is being used on a portion of the acreage this year. The major influence of the Gila project on the local and national economy has not yet been felt—it will be reflected primarily in the years ahead. ###

Evolution of Land Classification

(Continued from page 133)

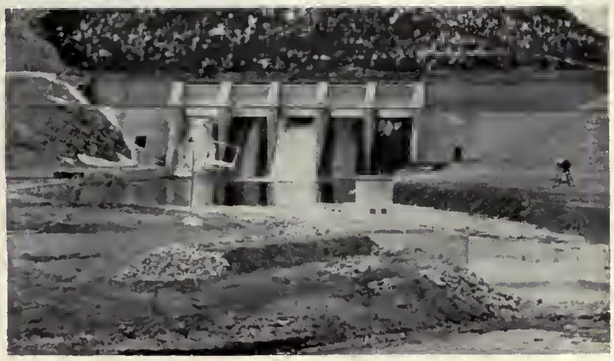
During the past half century, however, significant progress has been made in this country by various Federal and State agencies in developing methods and techniques for soil and land classification. Classification of land in the Federal Reclamation program began with the passage of the Reclamation Act of 1902, at which time only about 9 million acres of the 700 million acres of arid and mountainous land west of the 100th Meridian were irrigated through private initiative and cooperative effort. However, the value and permanency of this contribution to national expansion and wealth had been demonstrated by pioneering development and encouraged the passage of laws for Federal sponsorship of irrigation projects. Without this sponsorship, further irrigation development would have been rather hopeless because of the increasingly difficult engineering and financial problems involved in water conservation and use on a large scale.

With the passage of this act came also the Federal responsibility of making certain that lands of the right quality be served with water. It wa no longer possible to make random selection o land for irrigation.

The earliest land classification under Reclama tion law was on a geological basis alone—a basi which has since proved far from adequate. Littl recognition was given to the soil as a natural body that is, as a chemical, physical and organic mediu for growth. A few years before the passage of th Reclamation Act, the United States Departme of Agriculture, under the direction of Milto Whitney of the Bureau of Soils, initiated a pro gram of soil classification for defining an mapping the important soil types in this countr For agronomic purposes, these soils were large identified by their relationships to geological dat although surface textures were recognized in th unit of classification. Mapping units were giv geographical names, which together with textu and geological origin of parent material, gave ri to the soil series and type. Soil mapping has co tinued to the present time, and the mapping uni of soil types and phases are also based on ma

(Please turn to page 154)

How a Conservancy District Works



TO FIRM UP THE WATER SUPPLY *far areas like the one above near Loveland, Calo., the Colorado-Big Thompson's features, like Olympus Dam (inset) are nearing completion. Farm phata by Clarence B. Haney, Region 7 photographer. Phata af dam by Skeets Calvin.*

by J. M. DILLE, Secretary-Manager
Northern Colorado Water Conservancy District

Adapted from an address, January 17, 1952, during the Water Users Conference, at which the Four States Irrigation Council was organized at the Denver Federal Center, Denver, Colo.

Part 2—Organizing the District

As a matter of interest, I might say that when orthern Colorado people first contacted the Bu- eau, Hoover Dam, the first large power project, as not yet completed; Grand Coulee was just arting and other large developments we hear so uch about now were still a dream or in the plan- ing stage. A project, like ours, to furnish a upplemental water supply to a large already de- eloped area, was considerably different from nything the Bureau had previously undertaken.

Also, the general plan of diverting a large mount of water from the Colorado River water- ned and distributing the costs and benefits over his area, presented a great many difficult prob- ems.

The Bureau report, a 2-year job, proposed a roject to divert an average of 310,000 acre-feet nnually, with reservoirs, tunnels, canals, distri- ution ditches, power plants, and power lines to ompose a complete project for both irrigation nd power.

The people of the west slope were apprehensive hat the project would conflict with their use of ater and future development, and organized a rotective association. A number of meetings ere held in Western Colorado and in Denver which finally resulted in complete understanding and in agreements which protected the western slope interests. Those policy agreements were later included in Senate Document No. 80, Seventy-fifth Congress.

In 1936 when it became apparent that the report of the Bureau would be favorable, it was realized that some special form of entity was necessary to contract with the United States, guarantee repayment of construction costs, and operate the completed project for the largest benefit to the area.

The wide differences in present water supplies throughout the District indicated the need for a water distribution plan that would be elastic and perhaps largely voluntary on the part of each user.

Also, it was believed that some part of the cost should be borne by the general public as a reflection of the benefits to the general prosperity from increased and stabilized water supply. These and many other considerations indicated that some form of conservancy district might be the answer.

After many months of effort, all of the ideas were incorporated in a bill providing for the organization of State Water Conservancy Districts which was presented to the 1937 Session of the General Assembly.

This bill passed without objection and became law in May 1937. In May 1938, the Supreme Court of the State rendered an unanimous opinion in a "Quo Warranto" proceeding upholding the constitutionality of the act.

The act is lengthy, but in brief it provides for the organization of conservancy districts by any district court upon petition of a required number of property owners. The board of directors is appointed by the court.

The board appoints officers, has power to acquire and hold property, appropriate water, enter into contracts, levy taxes and assessments, allot water, and generally, to administer the business of the district.

As a reflection of indirect benefits, the board may levy taxes on all real and personal property but not to exceed one-half mill during the construction period of the project nor to exceed one mill thereafter except in case of default or deficiency when an additional one-half mill is permitted. The collection of all taxes and assessments is made by the various county taxing officials and then remitted to the district.

Perhaps, to those of you from other States of the Missouri Basin, our financial plan of obtaining some contribution from all general taxpayers within the district may offer at least one method for covering such costs as are beyond the ability of water users to repay.

In the case of our own district, it is estimated that the one mill tax on property will provide fully one-fourth of the annual income required to meet the repayment installments and other obligations of the district.

I may say that so far, during the construction period of the project, the district organization has operated satisfactorily. With a levy of only three-tenths of a mill instead of the five-tenths permitted by the law, the district has maintained a modest organization to cooperate with the Bureau of Reclamation in every way we can and to prepare for operation of the project.

There was practically no objection whatever to the plan for a mill tax on all property. Even the large taxpaying corporations and utilities recognized the equity of the tax.

As the justification for the tax is based entirely on the theory of "indirect benefits," with no relation to any ability to supply water, the question arose as to how to define the boundaries of the district. As a practical solution, the boundary follows the closest section lines outside the irrigated area although the extent of certain indirect benefits beyond this area is problematical.

The act further provides procedures for allotting water to individuals, municipalities, and irrigation districts and for collecting special assessments for the use of such water. The board has the power to contract with the United States for construction of works when authorized by an election of property owners.

During the summer of 1937, the association laid out the boundary lines of the proposed district and circulated petitions to the District Court of Weld County for the formation of the district.

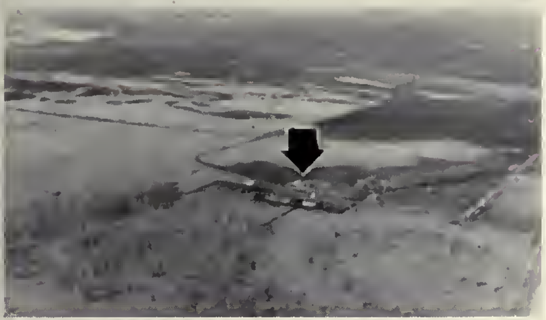
No protesting petition was presented and on September 20, 1937, the court held the hearing required by the law and issued a decree establishing the Northern Colorado Water Conservancy District. (Please turn to page 149)

FROM SINGLE TO MULTIPLE PURPOSE PROJECTS—The author, J. M. Dille, in 1910 (lower left) while Superintendent of the Empire Reservoir near Fort Morgan, Colo. At lower right, Dille inspects a Colorado-Big Thompson siphon, about 30 years later. Photographers unknown.

The Valley of Milk River

Part 2—A MILK RIVER RANCHER

by PARKER E. HEIKES, Associate County Extension Agent, Malta, Mont.



AFTER THE FLOOD—Arrow points to the Steve Holman farm, as it looked on April 6, 1952, snug and safe behind its ramparts of dirt. People laughed at Holman when he began building high dikes in anticipation of heavy spring runoff. The water came to within 6 inches of the top of his dikes. ***Photo submitted by the Milk River project.***

The old timers of the Milk River Valley in [illegible]ontana will now refer to the flood of "52" as the [illegible]e to remember.

Settlers often boasted of having seen the [illegible]Muddy Milk" fill the valley from hill to hill, but [illegible]is year's flood will put an end to the arguments [illegible]bout which was the highest, the flood of 1906, [illegible]923, 1939, or 1952. The melting snow water [illegible]hich covered nearly 90 percent of the irrigation [illegible]roject in April of 1952 reached the highest level [illegible]n record.

Steve Holman, who came to Montana from Illi[illegible]ois in 1913, had experienced several floods during [illegible]e years on his irrigated farm near Dodson, and [illegible]ecause of foresight and hours of hard work, he [illegible]as able to keep the water out of his buildings, [illegible]nd prevented thousands of dollars of loss.

Most stockmen check and clean the snow from [illegible]e spillways of their stockwater dams before the [illegible]ring runoff. While doing this, Steve realized [illegible]ow much runoff there might be. This was sev[illegible]ral weeks before the river reached its crest. The [illegible]unoff had already started in the Havre area to [illegible]e west, and Fresno Dam was full and spilling [illegible]ver, when Steve, after considerable study and [illegible]hought, started building dikes around his build-

STEVE HOLMAN, advocate of improved irrigation practices. ***Photo taken October 1951 by Donald H. Demarest, former Region 6 photographer.***

ings and feed lots. Because the land near his buildings was either frozen or wet, he had to haul dirt for nearly 1 mile. Many people passing by thought he was crazy for building such high dikes. In the beginning he planned to build them high enough to withstand 2 feet more water than in 1939. But he changed his plans as flood news began coming in. He hauled dirt with a caterpillar tractor and scraper for 3 days. For six 24-hour days, he used two similar sets of dirt moving machinery. When the flood reached its crest, his dikes had 6 inches of freeboard.

Although there is still some water on his farm land, he is quite optimistic about the future. There will be some silt deposits and the river has done some washing but he believes that 80 percent of his alfalfa will survive even though the water covered it completely for nearly 3 weeks.

The extent of damage to farms on the project is yet impossible to determine, but it is certain it will be great. Several farmsteads now have river channels between the house and barn. Farm land has been either badly eroded or covered with silt. Alfalfa fields and pastures have been either washed or smothered out. Some farm ditches are completely leveled. Drain ditches will need repair.

Steve Holman believes his loss will be small but only because he foresaw the water that was to come and started preparing early.

Holman raised his family of eight children on a dry land homestead, 6 miles north of Wagner, Mont. While there he farmed nearly 1,000 acres annually, mainly dry-land wheat with some oats and barley. Because of his past experience in Illinois, where his father did considerable livestock feeding and followed a general livestock type of farming, Steve turned to raising purebred Hereford cattle early in his farming career. He purchased his first purebred Hereford cows from his brother, who was still living in Illinois, for $275 a head.

Due to his expert judgment of cattle and his devoted interest in general agricultural development, Steve has probably done as much as any one individual to improve the livestock industry in the Milk River area. Holman's stock is of high quality and has been purchased by stockmen throughout the Western States for commercial and show purposes. At the present time he is running approximately 750 head of Hereford cattle, most of them purebred. Although there is a constant outside demand for his breeding stock he frequently sells to local small farmers and stockmen and thus improves the general grade of livestock and helps many new stockmen get started.

Even while dry-land farming, Steve was constantly looking to the irrigated valley for much of his winter feed. It was not until 1927 that he left the dry-land homestead and moved to his present location near Dodson. Before this time he had leased irrigated land in the Dodson area to raise hay for winter feeding.

In its undeveloped condition Holman's irrigated land was extremely uneven, as is much of the better land in the Milk River Valley, and very difficult to irrigate. His irrigation system was very inefficient, mostly general flooding with a few dikes to help pond the water. By this method much of his land was over irrigated and the efficiency of water use was extremely low.

EFFICIENT IRRIGATION—MAXIMUM PRODUCTION—Below, sheep on fall pasture in irrigated alfalfa field at Milk River. At right, fields are properly leveled and prepared on the Steve Holman farm. The equipment comes in handy for flood control. ***Both photos by Donald H. Demarest, former Region 6 photographer.***

Development costs for this type of land are [q]ite high, but the investment has paid off in more [w]ays than one.

Without the three caterpillar tractors and the [o]ther complete line of land-leveling and dirt-[mo]ving equipment which he had bought to de[ve]lop approximately 450 acres of the irrigated [la]nd he and his four sons own in the Milk River [V]alley, Holman might not have been able to save [hi]s farm buildings during the flood.

Originally, they bought the equipment to attain [mo]re efficient irrigation, as they thoroughly recog[ni]ze the value of irrigation and land development. Holman keeps this equipment in operation [th]roughout the frost-free season. There is con[st]ant demand for his equipment, by neighbors and [ot]her irrigation farmers, and he does some work [fo]r friends as a neighborly gesture and to [he]lp develop the irrigation project. The results [an]d observations of his farming operations have [be]en invaluable in stimulating irrigation interest [an]d assisting in the development of the irrigation [pr]oject. The Dodson area has long been recog[ni]zed as one of the most developed and prosperous [po]rtions of the Milk River project.

When asked what he considered the most im[po]rtant steps leading up to his present success as [a]n irrigation farmer, Steve said "Developing my [la]nd for fast efficient irrigation and combining [li]vestock with my irrigation farming operations." [H]e is a strong believer in soil fertility and puts [co]nsiderable value in his livestock merely for [m]aintaining this fertility with resultant high crop [pr]oduction. He believes there is little use in go[in]g to the expense of irrigation development, if [so]il fertility is forgotten. Although the Milk [R]iver project borders stock and range coun[tr]y throughout its length, Steve believes that irri[ga]ted pastures can and will compete very [fa]vorably with the less valuable range land.

While his livestock herd and feed requirements [w]ere small, Steve followed a more intensive type [o]f farming. He has had sugar beet yields averag[in]g 18 tons per acre and has also raised some pota[to]es and corn. Now it requires nearly all of his [ir]rigated land to produce the necessary feed for his [H]erefords. Most of his hay land is in high-pro[d]ucing alfalfa. However, he still feeds some na[ti]ve bluejoint hay. It is not uncommon for his [al]falfa yields to average more than 4 tons per acre [f]rom two cuttings. He also considers that 100 [b]ushels per acre for oats is a normal yield.

Steve, together with his sons, is considered one of the largest operators in the Milk River area, and is respected and admired by other farmers and stockmen. His present success is the result of hard work and faith in the future. He has proven to many less optimistic settlers that the Milk River project has almost unlimited opportunity for the farmer who has a wholehearted interest in irrigation and a willingness to work and learn. He is constantly planning for the future and believes that his sons and grandsons will have opportunities equal to, if not greater than, his and that they, through proper management, hard work, and faith, may live a happy and prosperous life under irrigated agriculture in the Milk River Valley.

(NEXT MONTH—A MILK RIVER FARMER)

How a Conservancy District Works

(Continued from page 146)

After the district was organized and the first directors appointed by the court in 1937, the next big step was the negotiation of a contract with the United States.

At that time most Reclamation projects had been for the development of new land and the problems involved in a supplemental water project were new and complex.

Very briefly, a contract was finally drafted, approved by an election of over 8,000 taxpayers, and executed in July, 1938.

This contract described the 34 features designed to constitute a power and irrigation project for the diversion of 310,000 acre-feet of water from the Colorado River.

These features will collect and store the water on the westrn slope, divert it through the 13-mile tunnel, pass it through several power plants along the 2,900-foot fall down the eastern slope and store it in two large reservoirs in the foothills for delivery into our local streams by the district.

For the final use of the water for irrigation and domestic purposes, the district is to repay $25,000,000 in forty (40) scheduled annual payments beginning when the project is completed and the water is available.

The power features and revenues are retained by the Government to defray the balance of the construction cost.

Operation and maintenance costs will be divided equally on so-called "joint" featnres.

(NEXT MONTH—MANAGING THE DISTRICT)

"WE BUILT OUR OWN HOUSE."—At upper left, the GI tent they lived in for a while. Above, everybody helps. At immediate left, the Burns family: Patty and Joey standing out in front, their mother, Mary Ann (holding the "chosen" son), and their father, John Burns, who proudly says . . .

"THIS IS MINE"

by JOHN J. BURNS, Homesteader, Yakima project, Wash., as told to Stan Rasmussen, Region I Photographer

PHOTOS BY RASMUSSEN

A MAN WHO OWNS LAND has a share in the wealth of America.

The way I look at it, everything this country has is based on its resources. When you speak of wealth you're thinking of what this old earth has to offer. I believe that sincerely and that's why I put in for the Roza homestead drawing back in 1947. A guy would have to believe as I do to come out here for a gamble on a piece of sagebrush land.

It's a lot more than that, too. But let me start at the beginning when we pulled in here on June 17, 1947. We built temporary living quarters out of a GI tent we bought for $30. We wanted something a little better than just a tent so I constructed a sturdy floor and some sidewalls to the thing. That kept our household appliances up out of the dirt. The total cost of that home was about a hundred bucks.

I have the foresight and fortitude of my wife Mary Ann to thank that we didn't give the whole thing up. I worried about the kids. Patty was three at the time and Joey was only 13 months and boy, was it dirty! Well, anyway, that was our home for the next 5 months.

During that time we managed to build a pumice-block house and get a well dug. You never saw a happier bunch when the first water came gurgling up out of that pipe. We had been hauling water by the tubful on our old truck from a neighbor's place a quarter of a mile up the road. Not just a little water either. We had to haul enough to water four cows besides taking care of the washings and the Saturday night baths.

Financially, we didn't make much headway that first year. From our crops we realized a clear profit of $90. We had spent $2,800, of which $1,700 had gone for machinery and equipment. And there were a couple of outstanding loans, too, one for a thousand on the house and another for $1,600 that the FHA loaned us to dig the well.

You're probably wondering how we kept going. Vell, being a vet I qualified for GI schooling ffered the homesteaders, and in my case it paid 93.75 a month. It sure came in handy that first vinter, too, because it was a rough one. We had blizzard here and it stayed at three below for spell. A bunch of our banty chickens froze to eath and we had to bring our cat and dog into he house to keep them alive. They were so frozen p we had to scrape the ice off them. In the pring one of the cows came with a calf which eveloped pneumonia and we had to keep it in he house for awhile, too. Like I was saying, Things were rough."

Even with troubles like that we did quite a bit better on the crops that second year. Our gross profit ran a little more than $5,000, of which we put out about $3,200 for expenses. That left us a net of approximately $100 per month for the year. That's how it looked on the books but actually it didn't work out that way. In July Mary Ann went to the hospital to have a baby that didn't live. Things were pretty rough for her, too, for about 6 weeks. They were giving her transfusions about as fast as she could take them. That siege cost us a neat $1,200 in hospital and doctor bills, or just about all the money we made that year.

In 1949, things started to take a gentle turn for

THANKS TO MY WIFE."—Burns believes his wife's foresight nd fortitude were responsible for his perseverence. Above, she elps out with the farming. At upper right, Burns explains, I was raised on a dry farm so I didn't know much about farming ith a shovel." At right, Patty and Joey (barely visible behind e tub) help with the wash.

Our second year on the homestead was a little nore profitable. We paid off the loan on the ouse with $850 we got from 6 acres of dry beans nd $250 hay money. We had 25 acres of caning peas contracted which didn't pay off too ood, though. Only half of that 25 acres had been uid out correctly. As a result we were trying o run too much water up hill. We saw that it vasn't working so we got out there with buckets nd tried to save the peas but we lost them anyway.

I was raised on a dry farm over in the Palouse ountry so I didn't know anything about farming vith a shovel. That same spring, I tried to irriate a piece of ground with an open ditch when should have been using a flume. It kept breakng out and I stuck with it for three sleepless days nd nights before I gave in and bought the flume.

the better. We put in about 50 acres to peas, cantaloupe, alfalfa, and corn ensilage. Our gross profit was roughly $5,000 with $3,000 for expenses which left us a net of a couple of grand. We put $860 of that back into 1,300 feet of concrete pipe to improve our irrigation system. That's the year we proved up and got the little paper that said the homestead was ours.

The next year is the one that we're really proud of. We grossed $11,168. Oh yeah, about a thousand of that was earned by Mary Ann down at the hospital. She's a registered nurse and she went to work to get back some of the money we had put into that place. But even at that we did about $10,000 dollars worth of business here. Around $7,500 of that went for expenses and we ended up with a net of $2,612. I built a pumice-block machine shed that fall, 52 by 30 feet, for about 500 bucks. And we put in another 1,700 feet of concrete pipe to the tune of $1,140. You see, what I'm doing with that pipe is pumping some of my waste water back to high ground and using it again.

That brings us up to '51. We had a bad time with 20 acres of beans we raised; only got 218 sacks. But luckily there was a good side, too. From 18 acres of alfalfa we harvested 17,000 pounds of seed when cleaned. At 45 cents a pound you could say that we were making hay. That seed crop carried the rest of the farm around on its back. Next season I'm going to plant 31 more acres to alfalfa so the following season I'll have about 50 acres producing seed. This was a good year. We grossed $9,331 and our expenses were $4,901. That left us a pretty fair net profit. Just to add to that good fortune, the Roza Irrigation District is burying about a quarter of a mile of concrete pipe lateral and I'll be able to irrigate six more acres next season that have been dry up to now. But even better than that is little Dennis Patrick Burns, a young Irishman we adopted from the Catholic home in Seattle. From the looks of him he's going to be a big help around here one of these days.

Well, that's how we're homesteading on the Roza. We've learned a lot about running an irrigated farm in the last 5 years. And most of it came to us the hard way. Such as learning to operate flexibly. If a farmer doesn't change his plans in a hurry to cope with the bad breaks like the weather or a market going out at the wrong time, he's going to take a beating.

And we found that the Bureau of Reclamation's minimum requirement of $3,000 for moving on is low by about $2,000. It should be more like $5,000 and not more than half of that in farm equipment. But that battle is behind us. Right now it gives me a pretty good feeling to look over my bank financial statement. It reads: Assets $32,000. Liabilities $4,000. We came up here with $900 cash and with little or no credit. When it comes to loose cash, though, my pocket feels just about as empty now as it did then.

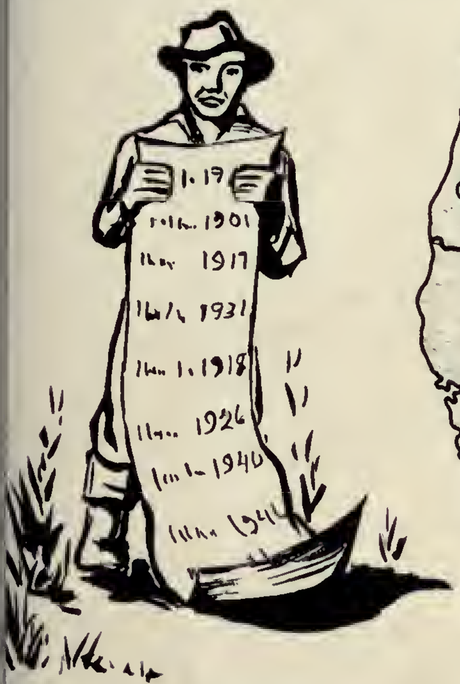
But, you know, when I'm out walking across those plowed fields, every once in awhile I reach down and grab a handful of soil, just like Scarlett O'Hara did in "Gone with the Wind," and while I'm enjoying the good feel of it, I say to myself, "This is mine." ###

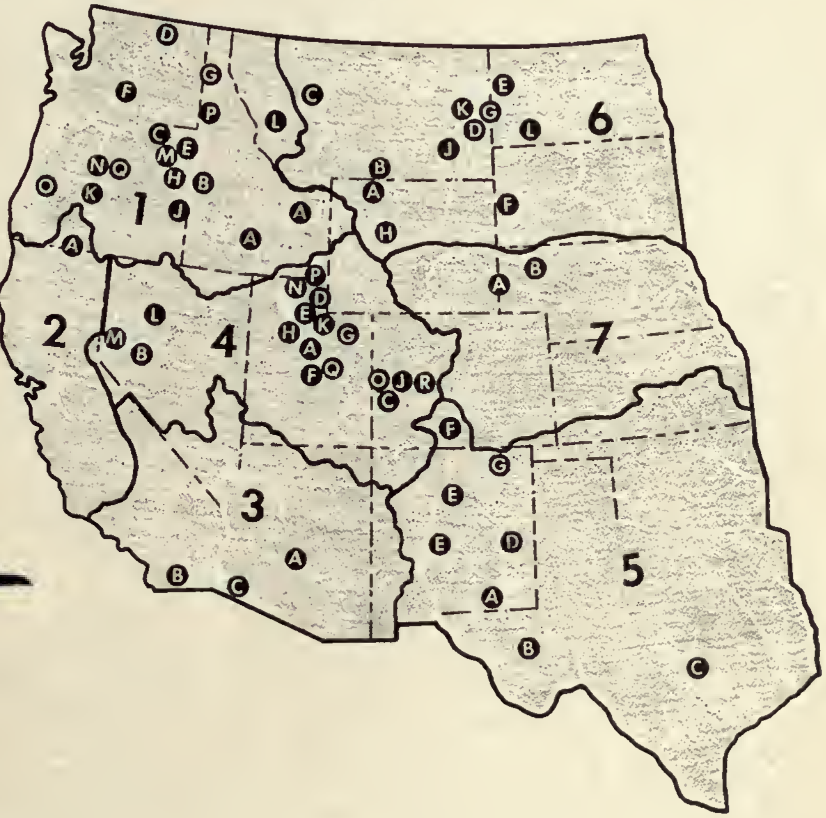
"A GOOD YEAR—The alfalfa seed crop carried the rest of the farm around on its back."

WE, the WATER USERS, Operate These Reclamation Projects

The policy of the Department of the Interior and the Bureau of Reclamation has been and continues to be one of encouraging the water users to operate their own distribution systems as soon as the project area has reached such a stage of development and settlement that local water users' orgnizations can safely assume the responsibility. The Bureau of Reclamation is responsible for the return of the investment of the United States, and transfer of Government property to an organization is dependent on that organization being well managed, well financed, and willing to take over operation.

The map above, and the table below show 87 projects, divisions of projects, or features of projects which have been turned over to, or operated continuously by, the water users since the Bureau started operating.





Region and Symbol	Project	Date of Transfer
	Minidoka—Gravity Div.	1917
	Minidoka—S. Pumping Div.	1926
	Minidoka—Gooding Div.	1933
	Minidoka—Upper Snake Div.	(1)
	Boise—Arrowrock Div.	1926
	Boise—Notus Div.	1922
	Umatilla—East Div.	1926
	Umatilla—West Div.	1926
	Okanogan	1929
	Baker	1932
	Yakima—Kittitas Div.	1934
	Yakima—Sunnyside Div.	1945
	YakimaTieton Div.	1947
	Yakima—Kennewick Div.	(1)
	Rathdrum Prairie—Hayden Lake	(1)
	Rathdrum Prairie—Post Falls	1949
	Vale	1949
	Owyhee	1952
	Arnold	1952
	Bitter Root	1952
	Burnt River	1952
	Deschutes	1952
	Grants Pass	1952
	Lewiston Orchards	1952
	Ochoco	1952
	Klamath—Langell Valley Div.	1926
	Klamath—Bonanza Springs	(1)
	Klamath—Lower Klamath Lake	(1)
	Klamath—Pumping Div—(Grove)	(1)
	Klamath—Pumping Div—(Enterprise)	(1)
	Klamath—Pumping Div—(Shasta View)	(1)
	Klamath—Pumping Div—(Malin)	(1)
	Klamath—Pumping Div—(Sunnyside)	(1)
	Klamath—Pumping Div—(Van Brimmer Ditch)	(1)
	Salt River	1917

Region and Symbol	Project	Date of Transfer
3–B	All American Canal—Imperial Div	1947
	All American Canal—Coachella Div	[2] 1949
3–C	Yuma—Valley Division	1951
4–A	Strawberry Valley—High Line Canal	1916
	Strawberry Valley—Mapleton Lateral	1918
	Strawberry Valley project	1926
4–B	Newlands	1926
4–C	Uncompahgre	1932
4–D	Hyrum	1936
4–E	Ogden River—Ogden R.	1937
	Ogden River—S. Ogden	[2] 1951
4–F	Sanpete—Ephraim Div.	1937
	Sanpete—Spring City Div.	1941
4–G	Moon Lake	1938
4–H	Provo River—Deer Creek Div.	(1)
	Provo River—Aqueduct Div.	[2] 1951–52
4–J	Fruitgrowers	1940
4–K	Weber River	1940
4–L	Humboldt	1941
4–M	Truckee Storage	1942
4–N	Newton	1948
4–O	Grand Valley—Garfield Gravity Div.	1949
	Grand Valley—Orchard Mesa Div.	(1)
4–P	Scofield	1949
4–Q	Preston Bench	1951
4–R	Paonia	(1)
5–A	Carlsbad	1949

Region and Symbol	Project	Date of Transfer
5–B	Balmorhea	1951
5–C	Colorado River—Marshall Ford Dam	(1)
5–D	Fort Sumner	(1)
5–E	Middle Rio Grande	(1)
5–F	San Luis Valley—Conejos Div.	(1)
5–G	Vermejo	(1)
6–A	Shoshone—Garland Div.	1927
	Shoshone—Frannie Div.	1930
	Shoshone—Willwood Div.	1949
6–B	Huntley	1928
6–C	Sun River—Greenfields Div.	1931
	Sun River—Fort Shaw Div.	(1)
6–D	Lower Yellowstone	1932
6–E	Buford-Trenton	1944
6–F	Belle Fourche	1949
6–G	Savage	1950
6–H	Riverton—Midvale Div.	1951
6–J	Buffalo Rapids—1st. Div.	(1)
	Buffalo Rapids—2d. Div.	(1)
6–K	Intake	(1)
6–L	Missouri River—Dickinson Unit	(1)
7–A	North Platte—Fort Laramie Div.	1926–27
	North Platte—Interstate Div.	1926–27
	North Platte—Northport Div.	1926–27
7–B	Mirage Flats	1951

[1] Operated by the water users from the beginning.
[2] Water users take over as structures are completed.

NEWLANDS—First in Service

(Continued from page 132)

farms have spots of poor soil, but the Omnibus Adjustment Act of 1926 helped this situation by reducing the project area to include only those lands which could produce. The project now includes 72,000 irrigable acres. Other projects have benefited from this experience, and the complete land classification of all proposed developments gives each settler a working inventory of the type of land he is getting.

The first water was delivered from simple diversion structures. Water supplies would start dwindling sharply after the first of July. This problem was solved when the desert bed of ancient Lake Lahontan, dry since prehistoric times, began to fill behind Lahontan Dam, completed in 1915. Carson River, behind the 162-foot-high, 5,400-foot-long dam, was backed up 28 to 30 miles, creating Lahontan Reservoir. This reservoir, which also receives water from Lake Tahoe and Truckee River via a 31-mile diversion canal, can hold approximately 290,000 acre-feet of water, releasing it as needed into the river channel and diverting it 5 miles below the dam for delivery to ranches through a 600-mile system of canals and laterals. Lahonton Reservoir has never yet failed the ranches of the project, although there were three close calls during the limited storage years of 1924, 1929, and 1931. However, enough water was delivered to help assure a harvest.

Thanks to the foresight of the Newlands project planners, the possibilities for incidental power production at Lahontan Dam were not overlooked. A hydroelectric plant, which now has a capacity of 1,640 kilowatts, was completed in 1911, 4 years ahead of the dam. As a result, the city of Fallon now purchases its power from the Truckee-Carson Irrigation District, the revenues aiding materially in project cost repayment. In 1949, the District installed two diesel generating plants at the dam, having an installed capacity of 2,000 kilowatts, bringing the total power plant capacity to 3,640 kilowatts. The project water users formed local improvement districts and constructed power lines over which electricity hums to most of the farms.

In 1900 nobody knew much about Fallon, Nev. Nobody lived there. Today, Fallon has an ultramodern high school, municipally owned telephone, water, and sewer systems, a swimming pool, and plans for a large municipal airport.

Recently, the trade area of Fallon was selected by agricultural scientists as the basis of a study to attempt to measure in dollars and cents the direct and indirect benefits accruing from irrigated agriculture in an area where little or no agricultural production is possible without irrigation. The study disclosed that 172 businesses established in the Fallon area enjoyed a gross income of $12,363,300 in 1948, as compared with a $3,192,000 crop value—not counting the values from livestock and livestock products.

Even without the wealth-producing value of livestock at Newlands, reclamation has thus created a commonwealth in the area adding 15 million to 20 million dollars a year to the economy of Nevada and the Nation, starting practically from scratch since the turn of the century.

No wonder they call it the "Newlands Act of 1902" in Nevada! ###

Evolution of Land Classification

(Continued from page 144)

identifying soil characteristics. For instance, the Roswell sandy loam and Pecos sand were recognized and mapped in the Pecos Valley, New Mexico in 1899—one of the first surveys made. In the same year the Salt Lake Valley was mapped and the Salt Lake and Jordan series established. Many areas were mapped throughout the West in the following years and wherever available, these surveys were used as an aid for evaluating land for irrigation. So far, about 3,000 soil series have been identified and named, and within these series are many more soil types and phases.

However, as irrigation projects grew in size and complexity under the Reclamation Service established in 1907 (becoming the Bureau of Reclamation in 1923) land classification continued to increase in importance along with the need to discover better ways to determine the suitability of land for development. The standards for classification were constantly improved with new developments, particularly in the field of soils. To further this objective, the aid of Federal and State agricultural agencies engaged in soils investigations and research was solicited. Committees were appointed from colleges, agricultural experiment stations, and other sources to review praise, classify, and otherwise evaluate land in ation to reclamation suitability.

The Fact Finders Act of 1924 was even more cific about land classification. The act charged Secretary of the Interior with the responsi- ity for making certain that the irrigable lands each new project and new division of a project re classified with respect to their capacity under roper agricultural program to support a farm nily and pay water charges, and further, that ferent construction charges should be set against ferent land classes. Subsequent legislation, l especially the Reclamation Project Act of 39, re-emphasized and expanded the above re- onsibilities to include reconsideration of land ssification on existing projects in relation to the esent productivity of the lands and their capac- to repay construction costs as shown by ex- rience.

The present system of land classification has en in effect since 1924 when it became essential the Bureau of Reclamation to set up its own land classification program supervised by its own personnel. It was initiated and developed over a period of several years with the cooperation of several members of the Department of Agriculture who were assigned to the Bureau of Reclamation at that time and has been continuously improved since then. It has for its specific objective the determination of the extent and degree of suita- bility of lands for sustained irrigation farming. Physical land features are evaluated not only in terms of productive capacity of the soils, but of the equally important economic considerations of costs of development and production. The proce- dures, techniques, and standards have been de- veloped particularly for evaluating lands in arid and semiarid regions on the basis of long experi- ence and continued study on irrigation projects. This classification, therefore, provides definite, sound, and relatively permanent basic data which are essential in solving economic and engineering problems in land reclamation.

(NEXT MONTH—WHAT CLASS LAND?)

NOTES FOR CONTRACTORS

Contracts Awarded During April 1952

.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
571	Davis Dam, Ariz.-Nev	Apr. 11	Four 5,100-kilovolt-ampere power capacitor equipments for Tucson substation, schedule 1.	Westinghouse Electric Corp., Denver, Colo.	$161,726
517	Colorado-Big Thompson, Colo.	Apr. 8	One 30,000-kilovolt-ampere synchronous condenser with control equipment for Gering substation.	Westinghouse Electric Corp., Denver, Colo.	326,146
519	Columbia Basin, Wash	Apr. 10	Construction of earthwork and structures for Potholes East canal and Pasco wasteway.	Phil McInnis and Henry George & Sons, Spokane, Wash.	562,216
522	Palisades, Idaho	Apr. 29	9,000 tons of bulk pozzolan for construction of Palisades dam and power plant, schedule 2.	Combustion By-Products Co., Chicago, Ill.	13,500
523	Cachuma, Calif	Apr. 25	2,700 tons of bulk pozzolan for construction of Tecolote tunnel, schedule 2.	Airox Co., Los Angles, Calif.	35,802
541	Missouri River Basin, S. Dak	Apr. 30	Three 8,333-kilovolt-ampere transformers for Watertown substation, schedule 1.	Pennsylvania Transformer Co., Cannonsburg, Pa.	110,345
541	Missouri River Basin, S. Dak	do	One 69,000-volt voltage-regulating transformer and one current transformer for Watertown substation, schedules 2 and 7.	General Electric Co., Denver, Colo.	61,884
545	Missouri River Basin, S. Dak	do	Three 8,333-kilovolt-ampere transformers for Huron substation, schedule 1.	Pennsylvania Transformer Co., Cannonsburg, Pa.	110,345
545	Missouri River Basin, S. Dak	do	One 69,000-volt voltage-regulating transformer and one current transformer for Huron substation, schedules 2 and 7.	General Electric Co., Denver, Colo.	61,884
548	Central Valley, Calif	Apr. 15	6 pier noses for turbine draft tubes at Folsom power plant	General Metals Corp., Oakland, Calif.	10,600
551	Missouri River Basin, S. Dak.	Apr. 30	One 6,000-kilovolt-ampere transformer for Sioux Falls substation, schedule 1.	Westinghouse Electric Corp., Denver, Colo.	53,505
551	Missouri River Basin, S. Dak.	do	Two 115,000-volt and one 34,500-volt horn-gap switches and four 115,000-volt and six 34,500-volt disconnecting switches for Sioux Falls substation, schedule 5.	Schwager-Wood Corp., Portland, Oreg.	14,933
552	Columbia Basin, Wash	Apr. 29	One 2,500-volt motor-control equipment assembly for Ringold pumping plant.	Lexington Electric Products Co., Inc., Newark, N. J.	20,141
553	Eklutna, Alaska	Apr. 18	Three 10,000/13,000-kilovolt-ampere transformers with lightning arresters for Anchorage substation, schedule 1.	Westinghouse Electric Corp., Denver, Colo.	125,228
555	Central Valley, Calif	Apr. 28	Three 230,000-volt circuit breakers for Elverta substation, schedule 2.	Brown Boveri Corp., New York, N. Y.	155,260
555	Central Valley, Calif	Apr. 29	Nine 230,000-volt disconnecting switches for Elverta substation, schedule 3.	Schwager-Wood Corp., Portland, Oreg.	47,069
558	Columbia Basin, Wash	Apr. 17	One 4.16-kilovolt motor-control switchgear assembly for Babcock pumping plant.	I-T-E Circuit Breaker Co., Philadelphia, Pa.	56,425
561	Missouri River Basin, Mont	Apr. 24	1 control board and 1 annunciator relay cabinet for Canyon Ferry power plant, schedule 1.	Kirkhof Electric Co., Grand Rapids, Mich.	37,400
561	do	Apr. 17	One 1,500-kilovolt-ampere station-service unit substation for Canyon Ferry power plant, schedule 2.	I-T-E Circuit Breaker Co., Philadelphia, Pa.	28,005
561	Missouri River Basin, Mont	Apr. 28	One alternating current board and one direct current control and distribution board for Canyon Ferry power plant, schedule 3.	Montana Electric Supply, Billings, Mont.	11,769
562	Central Valley, Calif	Apr. 10	Construction of 162,000-kilowatt Folsom power plant and appurtenant works.	Guy F. Atkinson Co., South San Francisco, Calif.	5,772,960

Contracts Awarded During April 1952—Continued

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Con amou
DC-3665	Columbia Basin, Wash	Apr. 3	Drilling holes for right riverbank investigation at Grand Coulee Dam.	Lynch Bros., Seattle, Wash	$1
DC-3666	Cachuma, Calif	Apr. 18	Construction of concrete pipelines and structures for Carpinteria section of South Coast conduit, schedule 2.	Ventura Pipeline Construction Co., Ventura, Calif.	23
DC-3666	do	do	Construction of concrete pipelines and structures for Carpenteria section of South Coast conduit and Sheffield control room, schedule 4.	ABC Construction Co., Inc., and R. J. Daum Construction Co., Norwalk, Calif.	1,47
DS-3668	Central Valley, Calif	Apr. 3	Anchor bolts for 40- by 24-foot radial gates at Nimbus dam	Schmitt Steel Co., Portland, Oreg.	1
DC-3669	Columbia Basin, Wash	Apr. 11	Construction of earthwork, pipelines, and structures for area P-3 laterals and sublaterals, Potholes East canal laterals.	Goodfellow Bros., Inc., Wenatchee, Wash.	2
DC-3670	Columbia Basin, Wash	Apr. 25	Construction of earthwork, pipelines, and structures for area E-4 laterals and sublaterals and county road relocation, East Low canal laterals, schedule 1.	Cherf Bros. Construction Co. and Sandkay Contractors, Inc., Ephrata, Wash.	9
DC-3672	Eklutna, Alaska	Apr. 9	Construction of 26 miles of Eklutna-Anchorage 115-kilovolt transmission line.	Wiggins Construction Co., Anchorage, Alaska	4
DC-3674	Columbia Basin, Wash	Apr. 10	Construction of Ringold pumping plant, discharge pipelines, and lateral pipeline for the pumping plant and appurtenant works, lateral PE-47, area P-8.	Otis Williams and Co., Helena, Mont.	1
DC-3675	Palisades, Idaho	Apr. 18	Construction of Palisades dam and power plant and relocation of roads.	J. A. Jones Construction Co. and Charles H. Tompkins Co., Seattle, Wash.	29,1
DC-3678	Central Valley, Calif	Apr. 3	Construction of earthwork, concrete lining, and structures for Tulare Main canal, Friant-Kern canal distribution system.	Thomas Construction Co., Fresno, Calif.	[illegible]
DC-3679	Davis Dam, Ariz.-Nev	Apr. 18	Construction of 69-kilovolt Davis switchyard and transformer circuit.	George E. Miller, Long Beach, Calif.	[illegible]
DC-3681	Missouri River Basin, Nebr	Apr. 23	Construction of earthwork and structures for laterals 3.4 to 27.8, inclusive, and sublaterals on Cambridge lateral system, schedule 3.	Claussen-Olson-Benner, Inc., Holdrege, Nebr.	4
DC-3682	Klamath, Oreg	Apr. 29	Construction of earthwork and structures for Lost River channel improvements, West canal enlargement, and W-1 lateral, Langell Valley.	McKinnon Construction Co., Sandy, Oreg.	[illegible]
DC-3683	Gila, Ariz	Apr. 25	Construction of earthwork, concrete canal lining, and structures for Mohawk canal; and Radium Hot Springs flood protection system.	Marshall, Haas and Royce, Belmont, Calif.	[illegible]
DC-3690	Missouri River Basin, Wyo	Apr. 22	Construction of 4.3 miles of Guernsey Tap-Guernsey 115-kilovolt transmission line.	American Electric Co., Caldwell, Idaho.	[illegible]
DC-3692	Central Valley, Calif	Apr. 9	Reinforcement of south levee for San Joaquin river crossing of Shasta-Tracy 230-kilovolt transmission lines Nos. 1 and 2.	Basalt Rock Co., Inc., Napa, Calif.	[illegible]
DC-3693	Missouri River Basin, Nebr	Apr. 18	Construction of drainage well and test shafts at Enders dam	Layne-Western Co., Omaha, Nebr.	[illegible]
DC-3708	Columbia Basin, Wash	Apr. 28	Construction EL25A wasteway and pumping plant for area E-2, East Low canal laterals.	McWaters and Bartlett, Boise, Idaho.	[illegible]
117C-145	Columbia Basin, Washington		Lining repair, West Canal, station 1+28.2 to station 345+98	Cherf Brothers Construction Co. and Sandkay Contractors, Inc., Ephrata, Wash.	[illegible]
200C-194	Central Valley, Calif	Apr. 1	Warehouse for Folsom power plant	daRoza and Ribal, Inc., Monterey, Calif.	1
200C-173A	Klamath, Oreg.-Calif	Apr. 7	Construction of pumping plants "R" & "S"	George R. Stacy, Tulelake, Calif.	1
600C-86	Missouri River Basin, S. Dak	do	Construction of two warehouses, offices, and vehicle storage buildings and sewage disposal and water-supply systems for Phillip and Armour substations, schedules 1 and 2.	Rand Construction Co., Rapid City, S. Dak.	[illegible]
600C-86	do	do	Construction of warehouse, office and vehicle storage building and sewage disposal and water-supply system for Sioux Falls substation, schedule 3.	Henkel Construction Co., Mason City, Iowa.	[illegible]
600C-86	do	Apr. 2	Construction of sewage disposal and water-supply systems and warehouse, office, and garage and storage buildings for Watertown substation, schedule 4.	McGrann Brothers Construction Co., Watertown, S. Dak.	[illegible]
601C-20	Shoshone, Wyo	Apr. 23	Clearing portion of Heart Mountain Government Camp Area.	Studer Construction Co., Billings, Mont.	[illegible]
605C-16	Buffalo Rapids, Mont	Apr. 21	Gate Valves, O'Fallon Creek channel change and additional canal and wasteway structures, schedules 1 and 3.	F. L. Flynn and Co., Billings, Mont.	[illegible]
605C-16	do	do	Gate Valves, O'Fallon Creek channel change and additional canal and wasteway structures, schedules 2, 5 and 6.	Ray E. Thompson Construction Co. and Lloyd Lockrem, Billings, Mont.	[illegible]
703C-238	Missouri River Basin, Colo	do	Construction of Julesberg substation	George W. Shelp, Rawlins, Wyo	[illegible]

Construction and Materials for Which Bids Will Be Requested by August 1952

Project	Description of work or material	Project	Description of work or material
Central Valley, Calif	Turbine draft-tube bulkhead gates and accessories for Folsom power plant.	Colorado-Big Thompson, Colo.	Construction of a temporary switchyard; dism[illegible] of existing wood structures; and reinstallat[illegible] electrical equipment for Green Mountain s[illegible] yard, near Kremmling, Colo.
Do	Two 6,500-gallon and two 2,000-gallon oil storage tanks for Nimbus power plant.		
Do	Three vertical-shaft, motor-driven 100 c. f. s. pumping units at 25- to 33-foot head for plants Nos. 1, 2, and 3; and one vertical-shaft, motor-driven 96 c. f. s. pumping unit at 52-foot head for plant No. 4 on the Contra Costa canal.	Do	Addition of 10,000-gallon septic tank, complet[illegible] effluent line and drying bed, to existing sys[illegible] Green Mountain Government Camp about 1[illegible] south of Kremmling, Colo.
Do	Landscaping and constructing operating roads at Tracy switchyard and pumping plant.	Colorado River Front Work and Levee System, Calif.	Design and fabricate a heavy-duty steel hull tu[illegible] capable of a 13,500-pound cable-pull, with[illegible] mum draft of 4½ feet loaded, for towing a dre[illegible] the Colorado River, near Needles, Calif.

Construction and Materials for Which Bids Will Be Requested by August 1952—Continued

Project	Description of work or material
do River Front k and Levee Sys- Calif.	Furnishing and erecting a 50- by 100-foot prefabricated steel shop and welding building at Needles, Calif.
bia Basin, Wash	Construction of 3 miles of 13.2-kilovolt, 3-phase, single-circuit, wood-pole transmission line between Bonneville Power Administration's Quincy substation and Babcock pumping plant, West canal lateral W35.9.
o	Removal of existing compressor building in industrial area at Coulee Dam; construction of a 30- by 35-foot concrete block structure with builtup roofing to house existing compressor; revisions to existing piping; and construction of access road and grading around the site.
o	Furnishing and installing heating and ventilating equipment at Grand Coulee pumping plant, and insulating materials to prevent water and drain piping from freezing.
o	Horizontal-shaft centrifugal-type motor-driven pumping units for lateral area E–5 as follows: Three 45 c. f. s. units and three 13.7 c. f. s. units at 47-foot head, and two 8 c. f. s. units at 86-foot head for Warden plant and relift plant; three 24 c. f. s. units at 56-foot head for EL–63.1 plant; one 9 c. f. s. unit at 60-foot head for EL–63.1E plant; two 7 c. f. s. units at 56-foot head for EL–61.7 plant; and two 8 c. f. s. units at 66-foot head for EL–61 plant, all on East Low canal.
Dam, Ariz.-Nev	Erecting steel structures for the 34.5-kilovolt installation at Yuma substation.
o	Erecting steel structures and installing power transformer and switching equipment for the 13.8-kilovolt installation at Tucson substation.
Wyo	Construction of 0.4 mile of 475 c. f. s. earth-lined Means canal; enlargement and rehabilitation of 6.5 miles of Eden canal to 300 c. f. s. capacity, part of which is to be lined; construction of 2 miles of 20 to 5 c. f. s. Eden canal laterals; and relocation of 0.35 mile of 670 c. f. s. Dry Sandy Creek channel, about 44 miles northwest of Rock Springs, Wyo.
na, Alaska	Two 115,000-volt power circuit breakers and seven 115,000-volt air-break switches for Eklutna switchyard.
	Two 3,000-gallon and two 1,000-gallon oil storage tanks for Eklutna power plant.
	Two vertical-shaft, turbine-type sump pumps with capacities of 2.5 c. f. s. at 17-foot head, one horizontal-shaft, centrifugal-type fire protection pump with a capacity of 400 g. p. m. at 200-foot head, and one gear-type oil pump with a capacity of 20 g. p. m. at 100 p. s. i. pressure for Eklutna power plant.
o	Main control board, distribution boards, and battery chargers for Anchorage substation.
Gila, Ariz	Construction of 13.6 miles of unreinforced concrete lined laterals and sublaterals for unit 2 of Mohawk distribution system near Roll, Ariz. One main lateral is to be 90 c. f. s. maximum capacity and several laterals and sublaterals are to be 45, 30, and 15 c. f. s. capacities with a minimum of 15 c. f. s. Work includes 110,000 cubic yards of excavation and construction of concrete turnouts, checks, check drops, siphons, and a timber bridge.
Hungry Horse, Mont	Construction of a section of relocated east side Forest Service telephone line about 50 miles southeast of Columbia Falls, Mont.
Kendrick, Wyo	One 65 c. f. m. and one 375 c. f. m. air compressors, 100 p. s. i. pressure, and one 8 c. f. m. portable air compressor, 350 p. s. i. pressure for Alcova power plant.
Do	Construction of Oregon Trail reinforced concrete drain inlet structure on Casper canal, and concrete check for lateral 218, about 10 miles west of Casper, Wyo.
Do	Construction of 13.8-kilovolt addition to Laramie substation, including placing concrete foundations, erecting structural steel, erecting a 20- by 20-foot prefabricated metal control house, and installing and connecting all electrical equipment furnished by the Government. The substation additions will have a 13.8-kilovolt bay, an auxiliary bus structure, two 115-kilovolt disconnecting switches, and three 115-kilovolt lightning arresters.
Missouri River Basin, Mont.	Completion of Canyon Ferry dam and power plant, consisting of installing embedded and nonembedded parts of three 23,500-horsepower turbines and three 16,667-kilovolt-ampere generators; miscellaneous metalwork; electrical equipment in power plant; erecting switchyard steel and installing equipment on roof of power plant; and constructing elevator tower on dam.
Missouri River Basin, Nebr.	Construction of 7,500-kilovolt-ampere Ogallala substation requires concrete foundations; erection of all structural steel; installation and connection of all electrical equipment furnished by the Government; and erection of a 16- by 20-foot Government-furnished control house. The substation is to have one 7,500-kilovolt-ampere, 3-phase transformer, one 115-kilovolt bay, and three 34.5-kilovolt bays.
Palisades, Idaho	Two 10,000-gallon and two 1,200-gallon oil storage tanks for Palisades power plant.
Do	Furnishing and installing four 30,000-kilovolt-ampere, 164 r. p. m., vertical waterwheel-driven generators with generator surge protective equipment assemblies for Palisades power plant.
Provo River, Utah	Placing 26,000 cubic yards of riprap on unprotected sections of river banks along 10-mile reach of Provo river channel above Deer Creek reservoir.

United States Department of the Interior, Oscar L. Chapman, Secretary

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Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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U. S. GOVERNMENT PRINTING OFFICE: 1952

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Reclamation's Golden Jubilee 1902-1952

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SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1.50 a year for persons residing in the United States and Canada; $2 a year for foreign subscriptions; special rate of $1 a year for members of water users' associations, and Bureau of Reclamation employees. No stamps, please!

OUR FRONT COVER

THE TOWN OF ST. THOMAS

WAGON WHEELS emerged as the waters of Lake Mead were drawn down to accommodate an expected record flow of the Colorado River this spring. About 17 years ago residents of St. Thomas moved out ahead of Lake Mead waters that began rising in 1935 and covered the town in 1937. The Federal Government reimbursed the residents for their land and moving costs. On Easter Sunday, 1952, former residents gathered at the site for a reunion, some families spreading their lunches on the cement floors of their old homes. *Photo by Mark Swain, Boulder Canyon project photographer, Region 3.*

35 YEARS AGO IN THE ERA

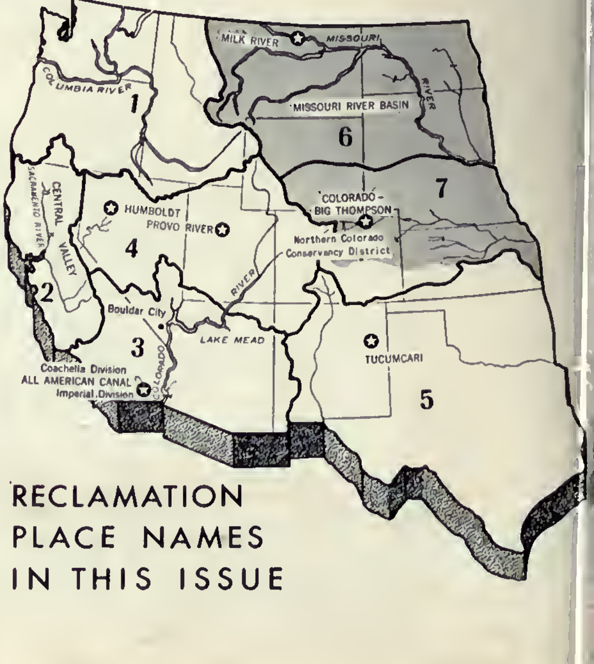
PLANNING THE FARMSTEAD

The arrangement of the farmstead is just as important to the farmer as is the arrangement of the factory to the manufacturer. Manufacturers are planning with the view of reducing labor and costs. They are learning to start raw material in one end of a building and bring a finished product out the other end with never a backward movement or a moment's delay in the procedure.

Now that thousands of men will be taken from farms to do the Nation's work in war, time and labor will be the big items on the farm for some years to come. If you are planning new buildings plan them for efficiency and locate them for efficiency. Plan them just as if every day in the year would be a busy day when every minute of time and every step is valuable.

Plan well, for planning takes but a short while and you will use your farmstead constantly for many years.

(From article entitled, "Hints From a Practical Farmer" by I. D. O'Donnell, supervisor of irrigation, page 329 of the July 1917 issue of the Reclamation Record, predecessor to the RECLAMATION ERA.)



RECLAMATION PLACE NAMES IN THIS ISSUE

RECLAMATION WAS READY.—Scenes of Tucumcari shortly after the water tank exploded. Arrows point to Bureau of Reclamation equipment. Two photos at top by Leo Rorabaugh, LeDeane Studio, Tucumcari, N. Mex., photo below by Paul W. Ball, Bureau of Reclamation.

A Tribute From Tucumcari

by WALT ROGAL, Editor, Tucumcari Daily News, Tucumcari, N. Mex.

IT WAS 4 A. M., DECEMBER 13, 1951. Tucumcari, . Mex., a city of 9,000 persons, lay asleep. Two inutes later there was a rumble of crashing strucires, pierced by screams of injured and frightied people. The city's water storage tank had illapsed without warning, dumping nearly two illion gallons of water into the densely poputed west end of the community. Homes were splintered, swept from their foundations. Four persons were killed, six injured.

Failure of a vertical weld in the 30-foot high, 100-foot diameter steel storage structure instantly released a 6,500-ton torrent of water upon the adjacent area. Twenty-four buildings, including many homes, were completely demolished or damaged in a four-block area. Loss was estimated

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at $750,000. Ten minutes after the alarm sounded, Bureau of Reclamation men and machinery were on the way, ready, willing, and able to help in Tucumcari's time of trouble.

Within a few weeks, almost all physical signs of the tragedy had been obliterated. Families who were made homeless by the catastrophe had been housed elsewhere and the city returned to its normal functions. But no community ever completely forgets incidents of this kind. The sympathy for those who lost loved ones and for those who sustained injuries is unremitting. And the stories of heroism, the accounts of instantaneous response of neighbors who gave unselfishly of their time and goods for the benefit of those in distress, are long remembered.

In the predawn hours that followed the collapse of the storage tank, city police, county officers, firemen, gas company officials, National Guardsmen, Red Cross and Salvation Army workers, city employees, and hundreds of ordinary citizens were giving all possible aid to those residing in the area of destruction.

RIO GRANDE EMPLOYEES CITED FOR SERVICE

On April 30, 1952, water and reclamation officials from West Texas and New Mexico joined in a ceremony marking the presentation of certificates of award and a unit citation from the Secretary of the Interior for outstanding service (see article, "Defeating the Rio Grande Drought" in last month's issue). Photographed during the ceremony, from left to right, standing: F. D. Postle, irrigation superintendent, Ysleta branch Ysleta, Tex.; John L. Gregg, treasurer-manager, Elephant Butte irrigation district, Las Cruces, N. Mex.; W. H. Gary, board chairman, Elephant Butte irrigation district; Labon Backer, chief, power operations, Elephant Butte, N. Mex.; E. S. Mayfield, irrigation superintendent, Las Cruces branch, Las Cruces, N. Mex., and N. B. Phillips, Manager, El Paso County water improvement district No. 1, El Paso, Tex. Sitting: L. R. Fiock, project manager of the Rio Grande project, El Paso, Tex.; H. E. Robbins, regional director, Amarillo, Tex., and W. F. Resch, assistant project manager Rio Grande project, El Paso, Tex. Photo courtesy of the *El Paso Herald Post.*

JANUARY 7, 1952.

Mr. RAY J. LYMAN,
Project Manager,
U. S. Bureau of Reclamation,
Tucumcari, N. M.

DEAR MR. LYMAN: On behalf of Mayor Clyde Dickinson, members of the city Commission and the city of Tucumcari, N. Mex. I wish to acknowledge with sincere appreciation the accomplishments of your organization during the tragic disaster created by the collapse of the Tucumcari water storage tank on December 13, 1951.

Your generous and immediate response to the urgency of the situation in providing men and equipment coupled with the outstanding leadership and direction of Mr. Ed Cerny greatly minimized the proportions of the accident and enabled the city to restore the water and power services so essential to the well-being of our community.

The U. S. Bureau of Reclamation is indeed fortunate to have the management of their Tucumcari project in such capable hands and the city of Tucumcari is grateful for the able assistance rendered.

Yours very truly,

J. A. FLEMING, *City Manager,*
City of Tucumcari, N. M.

One of the major roles of unselfish service w performed by the Tucumcari project office of t U. S. Bureau of Reclamation. Previously a gre many persons in Tucumcari probably had fail to recognize that agency as an integral part of t community's life. A functionary phase of t Federal Government, yes, but a very aloof or Many Tucumcari citizens spoke of the Bureau Reclamation in terms of the regional office. T "bosses" were in Amarillo or far-off Washingto D. C. The project office was believed to be mere a guardian of a Federal trust in the 42,000-ac irrigation project constructed by the Bureau. B Tucumcarians learned differently.

Bureau of Reclamation employees, includi engineers, were among the first to arrive in t distressed section of the city. Ray J. Lyma project manager, responded to the appeal of c engineer Bert Ridling by having Ed Cerny, o of his assistants, on the job with a collection heavy machinery en route to the stricken a within 10 minutes after the alarm had be sounded.

Eleven pieces of Bureau equipment, includi dump trucks, a truck hoist, acetylene cutting vices, a road maintainer, two heavy duty pow wagons, and a 93,000-pound dragline were cle ing away the debris before the sun broke throu the early morning shroud-like, murky clouds.

The task that confronted Bureau of Reclam tion forces was not a simple one. In those ea urs before daylight, live electric wires threat-ed the lives of the workers. No one knew if oken gas mains were discharging explosive mes. The possibility of damaged buildings col-osing upon the relief workers added to the known ngers.

Into the middle of the demolished area plunged e Bureau of Reclamation employees. Directed Cerny, equipment and crews were dispatched given areas. Hours later, streets that had been vered with shattered homes, broken glass, furni-re, electric meters, transmission and telephone res, were cleared to traffic. And all this had en accomplished without a scratch to any of the lunteers.

Today, the Bureau of Reclamation, from its local office to the headquarters of the Commissioner at Washington, D. C., is keenly aware of the damaging effects of the water storage tank's collapse in December. This agency, helpful in disaster, will do all that it can to help Tucumcari find a solution to its water problems.

The ties between the city and the Bureau, knitted more closely as a result of the Tucumcari disaster, are expected to be further strengthened. Since the life-blood of any community is an abundant supply of water, the people of Tucumcari and the Bureau of Reclamation may be able to join forces to develop a much-needed supply for present and future use. ###

hapman Honored on 19th Year of Public Service

More than 200 long-time friends and well ishers paid tribute to Secretary of the Interior scar L. Chapman during a luncheon at the Wil-rd Hotel on May 2, 1952, on his nineteenth an-versary of his connection with the Department the Interior, having taken office as Assistant ecretary of the Interior on May 4, 1933.

Joel D. Wolfsohn, Assistant to the Secretary, ad a congratulatory telegram from the Presi-nt of the United States at the luncheon, pre-led over by Dale E. Doty, Assistant Secretary r Public Land Management. Tributes to Sec-tary Chapman were paid by Senator Joseph C. 'Mahoney, Chairman of the Senate Committee Interior and Insular Affairs; and Representa-ve Michael J. Kirwan of Ohio, Chairman of the ouse Appropriations subcommittee on Interior. ational Park Service Director Conrad L. Wirth viewed the highlights of the Secretary's 19 ars of service with the Department.

The occasion was linked closely with Reclama-on's fiftieth anniversary or Golden Jubilee by telegram read by Assistant Reclamation Com-issioner Goodrich W. Lineweaver. The tele-am was signed by United States Senator Ernest . McFarland of Arizona, United States Repre-ntatives John R. Murdock and Harold A. Patten f Arizona, Undersecretary of the Interior Rich-d D. Searles and Commissioner of Reclamation ichael W. Straus who were participating in the eclamation Jubilee in Arizona. It read:

> From the State of Arizona, which owes so much of its owth and prosperity to the things your Department has done for the people of the West, we send you greetings and congratulations on your nineteenth anniversary as a public servant of Cabinet rank.
>
> You have carved out a new record unique in the annals of American Government as Assistant Secretary of Interior, as Under Secretary of Interior, and now as Secretary of Interior you have served as a Cabinet officer longer than any other American. You have been a tower of strength and a constant source of inspiration and wisdom for two great American Presidents over these past 19 years. You are the only member of the official family of our beloved late President, Franklin Delano Roosevelt, who has withstood the ravages of nearly two decades of the most difficult times our country has ever seen.
>
> It is doubtful that we shall ever see in our time or perhaps for generations to come a record of unbroken public service of such high rank, such unremitting devotion, and such marked success as yours.

The Arizona celebration of Reclamation's Golden Jubilee, included the dedication of Arizona's first 82,500 kilowatt generator at Hoover Dam, delivery of the first irrigation water to the Wellton-Mohawk project (representing the largest project to be authorized and constructed since the end of World War II), and recognition of the Salt River project as a major Reclamation development. A mammoth pageant "The Mask of the Yellow Moon" at Phoenix, Ariz., in which a cast of 3,000 people enacted the story of Reclamation in Arizona to the music of the Valley of the Sun Suite, was presented. The music was written specially for the occasion by Ferde Grefe, famed composer of the Grand Canyon Suite.

Secretary Chapman, who was accompanied to the luncheon by Mrs. Chapman, responded by praising the Department's progress in conservation and development of the Nation's natural resources. •

Coachella Drainage Investigations

ALL-IN-ONE OPERATION.—Drain tile can be installed at the rat of 300 to 400 feet an hour, down to 7½ feet below the groun with this 50-foot-long, 30-ton machine from Huntington, Calif It digs the trench, places gravel, lays the tile, covers it with im- pregnated paper, places gravel over the paper and backfills th trench. One worker remains in the "shoe" to set the tile in th gravel-lined trench, as another worker lowers the tile sections t him in this assembly-line operation. Photo above shows th machine in action in the Coachella Valley. *Photos by Kirby Hester Bureau of Reclamation*

PART 3—USING THE EVIDENCE

by J. S. REGER, Hydraulic Engineer, Coachella Division, All-American Canal System, Coachella, Calif.

> EDITOR'S NOTE: Parts 1 and 2 described the subsurface situation in the Coachella Valley, and the methods used by the four-agency Coachella Valley Cooperative Drainage Investigations to obtain information on the underground water and strata of the valley, including the use of piezometers, or self-casing, jetted and self-sinking wells, which not only furnish reliable data on the substrata, but remain in place as multiple purpose observation wells to detect the movements of ground water.

COACHELLA VALLEY NOW HAS over 700 "informants" on underground water activities.

In addition to the 42 two-inch wells originally installed by the hydraulic rotary drilling method, at well-calculated spots on a predetermined grid system designed to cover the entire valley are the tiny ⅜″ piezometers, sticking up about 2 or 3 feet above the surface, and probing from 18 to 140 feet into the ground. More are being added daily. If placed end to end, these piezometers would reach more than 8 miles below the earth's surface. These wells cost about 20 cents a foot to install, as compared with the cost of about $2 a foot for the cored wells drilled with the hydraulic rotary rig.

All of the Coachella drainage investigations are keyed to the observation wells. The investigators have plotted and designed 200 miles of sur face profiles at approximately right angles to th steepest slope of the valley floor, with respect t the two principal axes of the coordinate grid sys tem on which the wells are plotted. Thus the have a complete picture of the terrain.

As soon as they receive the graphic logs of eac observation well, the investigators add these dat on the subterranean conditions to the surface pro files, which gives them both surface and subsurfac information on master charts—some of which re semble large rolls of wallpaper, due to the spac required to indicate the information clearly an accurately. Because water tables fluctuate, the plot information about water levels on prints o transparencies.

The Coachella Valley Water District hires full-time "well reader" who patrols the "network reads the electrical indicator which shows th water level in each well, makes a record of eac reading, and turns the information over to th investigators for study or action as necessar Each well has its own designation so it can rated and related to the master charts, profiles, ınsparencies, and maps. Whenever a well re-rds an unusual fluctuation of the water table, nether a rise or decline, it is automatically termed "key well" and more frequent observations are ıde.

During the 4 years the investigations have been tively in progress, an estimated 10,000 ground ıter observations have been made and recorded. All this information is used to keep track of achella Valley's underground water. It has ready paid dividends as a "trouble shooter" be-re trouble occurred.

A group known as the Technical Committee, nsisting of one member from each of the four operating agencies, meets quite often to study chnical details, or to take emergency action. or example, in February 1949, less than a year ter the first wells had been installed, the resi-nt engineer and other members of the Technical ommittee noted that a drainage problem was ising in a 700-acre area in the eastern part of e valley. In places, the water table had risen less than 3 feet below the ground surface. The mmittee members decided to discover the cause d prescribe a remedy.

Surface profiles for this area were already otted and ready for use, as was the coordinated id system for additional wells in the observa-on network when needed. The members of the mmittee realized that the potential danger reatened adjoining land and located wells to observe conditions in a 1600-acre study area involving the "trouble spot." The Water District's jetting crew went into the area and installed 89 of the 3/8" wells. The "well reader" kept a close watch on the wells, recording the water level as soon as the wells had been jetted, making another reading before irrigations, during irrigations and after irrigations. The resident engineer used the information to prepare a water table contour map. Water District draftsmen helped plot the direction of flow of the ground water, the gradient or slope of the water table, and the characteristics of the subsurface materials, according to the logs of the jetted wells. By showing the surface contours on this same map, the depth to water at any location in the area could easily be calculated. Logs of the jetted wells were plotted on the previously prepared surface profiles, thereby affording a convenient method for studying the subsurface materials.

This area, which had previously been irrigated with pumped water, had been receiving a supplemental supply of water from the Colorado River since 1948. The ground water contour map showed a ground water mound under the irrigated area, and other information pointed to the conclusion that this was a semiperched underground water body which could be drained with a buried tile system.

Under the four-way agreement the combined members of the Investigations (Water District—University—Salinity Laboratory—Reclamation

TTING THE DATA TO THE TEST.—At left, below, a recent meet- of the technical committee. Left to right, R. W. Austin, ior drainage engineer, and R. C. Reeve, drainage and irrigation jineer, both from the United States Salinity Laboratory, Riverside, if.; J. S. Reger, hydraulic engineer, Bureau of Reclamation; A. F. sbury, associate professor of irrigation, University of California, Los Angeles, Calif., and J. R. Spencer, drainage engineer, Coachella Valley County Water District, Coachella, Calif. Not present when picture was taken was L. O. Weeks, deputy chief engineer, Coachella Valley County Water District. At right, below, R. C. Reeve at U. S. Salinity Laboratory, Riverside, testing Coachella Valley soils. *Photo at right, courtesy of U. S. Salinity Laboratory.*

Bureau) decide upon the most feasible method to correct any particular drainage problem and then recommend that method to the District, which is free to accept or reject the recommendation for any reason. In this case the District wholeheartedly approved the recommendation and the tile system was installed during February 1950. By July 1950 the water levels were from 1 to 3 feet lower than they had been a year before. Furthermore, there was a great improvement in the general appearance of the soil and the crops, mostly grapes and dates.

This is only one example of several drainage problems which have been and are now being solved before the ranch owners suffer any crop damage.

Another example of foresight on the part of the Investigators was that of obtaining samples of local ground water before Colorado River water arrived. The investigators knew that some of the local ground waters which had been used for irrigation purposes were high in sodium percentage and low in salt. Colorado River water, however, is just the opposite, being low in sodium and moderate in salt. This would affect drainage as Colorado River water would penetrate the soil faster than the local water. Fortunately, the original 42 wells were installed in time to furnish samples of the local ground water before it could become intermingled with the river water, thus affording an opportunity for scientific study of the "before and after" effects of the arrival of Colorado River water in the valley.

As additional data are obtained, evaluated and interpreted, detailed physical conditions which affect drainage in the valley are becoming more evident day by day. Other phases of the investigations include special studies relating to infiltration rates of irrigation water, salt removal methods, spacing of drainage tile lines, and the effectiveness and construction of drainage wells in the valley.

The investigations have aroused a considerable amount of interest among Federal, State, and private agencies. A private corporation, probably the largest of its kind in the world, recently sent two of its representatives to Coachella to study the method of attack and the techniques involved. This concern was embarking on a multimillion dollar agricultural undertaking in a foreign country in which drainage would apparently become a problem. A nationally known water well development concern has expressed a genuine interest i certain techniques.

The real worth of the program, however, lies i the fact that over 20,000 acres have already bee saved from the threat of a rising water table an a serious drainage problem. The sentries hav been posted, and the strategy board is alerte The underground is on the spot, all due to a bol cooperative adventure on the part of public servi agencies interested not only in developing, but i maintaining, the irrigated agriculture of th West. ###

Imperial Irrigation District Operates All-American Canal

The Imperial Irrigation District, on May 1 1952, assumed operation and maintenance of th diversion and desilting works on the Californi side of the Imperial Dam, main All-America Canal, and the common section of the Coachell Canal to Riverside County line in Californi under the terms of a supplemental contract be tween the district and the Bureau of Reclamatio executed March 4, 1952.

The Bureau of Reclamation will continue t operate and maintain the sluiceway sections o Imperial Dam and works at the Arizona end o the structure which serve as diversion and desilt ing facilities for the Gila project. It will also op erate turnouts serving the Yuma project Arizona. •

Flatiron and Pole Hill Near Completion

Secretary of the Interior Oscar L. Chapm announced the award of the contract to comple the Pole Hill power plant and Flatiron pow and pumping plant to the Eagle Erection Co. Shoshoni, Wyo. on May 9. These are the la major power features of the Colorado-Big Thom son project which will supply irrigation wat for 615,000 acres of land and 183,700 kilowatts hydroelectric power to a critically power sh area. Work on the Pole Hill plant was to beg early this month and be completed in about year. The Flatiron job will get under way mid-September, to be finished in a year.

The first integrated operation of the vast Co rado-Big Thompson project was initiated ceremonies at Loveland, Colo., last month on J 17, the Fiftieth Anniversary of the signing of Reclamation Act. •

C. PETRUS PETERSON. *Photo courtesy Townsend Studio.*

Reclamation's Hall of Fame

Nomination No. 13

C. Petrus PETERSON

PRESIDENT OF NRA

by MARCELLA ALLEN, Region 7 Headquarters, Denver, Colo.

C. Petrus Peterson, the new president of the ational Reclamation Association, is a big man hysically, a big man in his own home town and tate, and a big man among the "water boys," as e calls them.

Born of Swedish parents on a farm in Polk ounty, Nebr., he did not speak English until he arted to public school. He was slated to be a reacher and attended the old Luther Academy in Vahoo, Nebr., then Augustana College at Rock sland, Ill., where he received an A. B. degree. Ie then decided to be a lawyer, and graduated rom Law College in the University of Nebraska n 1909. In 1946 he was called back to Augustana o receive an LL. D. From this same College,)scar L. Chapman, Secretary of the Interior, arlier was given the same honor.

For a couple of years he practiced law in Wahoo, hen went into partnership with C. O. Whedon, he first general counsel of the Bankers Life Inurance Co., Lincoln, Nebr. When Mr. Whedon lied, young attorney Peterson became the next eneral counsel for the firm, which position he has ield ever since.

Senator Peterson served two terms, 1915–17, in the Nebraska House of Representatives, one term, 1919, in the Nebraska Senate. He was a member of the Nebraska Constitutional Convention in 1919–20.

Shortly after Nebraska adopted the nonpartisan unicameral legislature (so-called because it consists of one chamber of legislators) he served for four terms, 1941–43–45–47, and was speaker in 1945. He became a member of the Nebraska Legislative Council, during which time he served as chairman on the controversial water diversion subcommittee. He also became a member of the Nebraska Commission on Inter-governmental Cooperation in 1941 and is still serving in that capacity. He was vice president and chairman of the board of managers of the council of State governments, and continues to be a member. It was he who steered the council into studying the problem of ultimate management of the great Missouri River Basin development.

During the 1943 session of the legislature, the Central Nebraska Public Power and Irrigation District had a bill introduced to allow diversion of water from one river watershed to another. Tri-county, as the district is familiarly known, had built a whole project on the proposition that Platte River water could be diverted onto rich table lands lying between the Platte and the Republican Rivers. A suit was filed against the district to keep them from taking water out of the Platte onto that part of the table land that might be part of the Republican watershed. Somewhat unexpect-

(Please turn to page 175)

WHAT CLASS LAND?

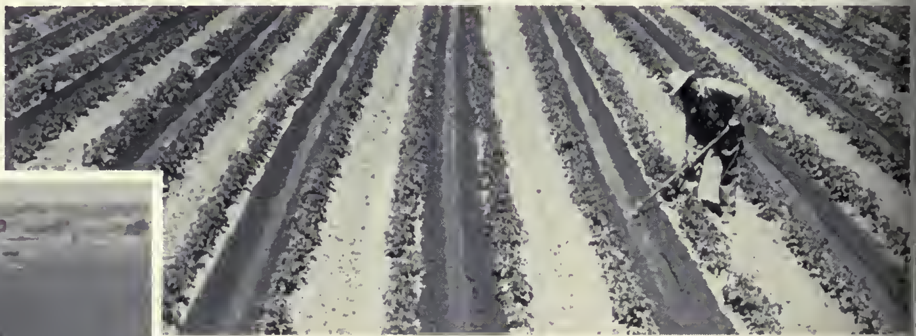
by H. N. WATENPAUGH, Reclamation Economist, Region 1, Boise, Idaho

Part 6 in a Series of Articles on Soils and Land Classification

No REPUTABLE BUSINESSMAN starts a new enterprise without first determining the possibilities of success. In doing this, he uses various yardsticks—population figures, building permits, and supply and demand charts. The Bureau of Reclamation does essentially the same thing. One of the many yardsticks is the land classification which was tailor-made for Reclamation needs and which is also of aid to you as a farmer on a Reclamation project.

Briefly, the land classification establishes, under the specific organization of a Federal Reclamation project, the extent and degree of the suitability of land for sustained irrigation farming.

When understood and properly used, this yardstick can be an indication to you of the relative success of your operations. This yardstick has



CLASS ONE.—Above, easy to irrigate, deep productive soil, can grow large variety of crops. CLASS TWO—At immediate left, rather steep slope makes handling water difficult if erosion is to be prevented. CLASS THREE—Lower left, rolling topography makes it difficult to irrigate, increases water use and operational expenses. Limited to hay and pasture crops. *Photos above and at lower left by Phil Merritt, photo at immediate left by Stan Rasmussen, both Region 1.*

no claim to infallibility, but it is the best that experience has developed. A man of average ability located on land classified as irrigable should have no difficulty in making a comfortable living, but to do this, especially on the land that just makes the grade, his farm size and organization must be right. If you are doing better than the yardstick measures for your land, you are no doubt making better use of your natural resources, or your farm organization and management practices are superior to those which are normally expected. This assumes, of course, that you had at the beginning of your farming operations only average personal opportunities and that you have not had unusual financial aid or personal expenses. If you are not doing so well, perhaps you had bet-r check up and see if your farm enterprise is e right size or your operations efficient, or perps your land should be reclassified.

Land classification is used by the Bureau in all hases of its activities—from initially measuring he land's suitability for use in a new project, rough indicating the desirable land use during evelopment and operation, to serving as a base r renegotiating contracts on established projects.

Because of the above personal and Bureau uses, is good business for you to know in more detail

LASS FOUR—At right, shallow or heavy soils not too profitable r general crops can be used for permanent pasture. CLASS VE—Below, waterlogged, but with good soil, and can be drained. drained, this land would be classed not higher than three because the cost of leveling. CLASS SIX—Lower right, sandy and hummocky—"nonarable." Would require too much water, cost too uch for leveling, wind erosion would be hard to control, and crop roduction limited. *Photo at right by Stan Rasmussen, photos below and at lower right by Phil Merritt, both Region 1 photographers.*

ust what your classification purports to do and f what it consists. The Bureau classification is n interpretation of the land's physical capabilities nto its economic possibilities. It takes into consideration the productive capacity of the land, farm development and production costs, as well as he costs of constructing, developing, and operting the project. In the process of classification by the Bureau, all the above factors, insofar as possible, are considered concurrently and the process kept fluid. Only in this way can the best end results be obtained. The following gives a pictorial concept of how irrigable land is determined.

Specifically, the classification is designed to answer the question: can the land or can it not, under a sustained irrigated agriculture, and when farmed n adequate units and when properly provided with the essential improvements of leveling, drainage, irrigation facilities, and the like (1) meet all production expenses, including irrigation operation and maintenance costs, (2) provide a reasonable return on investment, (3) repay its share of the cost of project facilities, and (4) provide a satisfactory level of living for the farm family?

The above is a long sentence, with a lot of when's, where's, and provided's, but if the land can do these things, it is "arable" and its irrigation is considered. If it does not meet this definition, the land is "nonarable" and should not be irrigated. The classification goes further, however, than just making this determination between arable and nonarable lands. It places the lands into six classes, according to their varying suitability for irrigation under the project's specific organization. Only classes 1, 2, 3, and 6 are in order of economic productive capacity. Classes 4 and 5 are reserved for special purposes. Now what is the meaning of each class used?

Lands suitable for a wide variety of crops—are placed in classes 1, 2 and 3 if they meet the other requirements for "arability" indicated above and to be discussed briefly later. Class 1 are the better of these lands and class 3 are those just meeting the requirements. Farms of the different

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classes, however, will provide comparable farming opportunities if properly managed in units of adequate size and if land values and related considerations are maintained in proper balance.

Class 4 lands are called "limited arable" because they may prove or have proved to be feasible for irrigation only under a special use. The reasons may be that they are only suited for use as pasture, but are desirable in the farm unit or project because they can be used efficiently with better lands; or thye are suitable for fruit production because they may have unusually good air drainage and market conditions are favorable; or, if there is a demand for small acreages, as is the case around most large cities, intensively worked, poorer quality land may be used for suburban purposes. Lands placed in class 4 may actually be more desirable for irrigation than classes 1, 2 and 3 as their special use or adaptability may make them economically more profitable to farm or own than other lands. They do, however, present specific problems which must be carefully studied before a determination is made as to their "irrigability" and then they must be used in accord with their capability.

The use of class 5 in the classification is an ingenious device to protect you as a farmer. If, for example, land is in need of project drainage or flood protection, it is placed in class 5 and charges are not made against it until the required reclamation is completed. Also this class is a useful tool in project planning for, if a question arises regarding a piece of land's suitability for inclusion in the project, it is tentatively classed as 5 until the problem is solved. In other words, class 5 contains suspended land. Only when the limitation is removed is it considered as arable land or suitable for irrigation.

If the problem is not corrected in a fixed period, the land is classified as class 6 and, therefore, should not be farmed under irrigation within an organized project. True, an exceptional farmer may successfully farm some of these class 6 lands, but, under the succeeding farmer, or under long-time production, they would be a burden to the project if included as irrigable. In fact, the better lands would support them.

In last month's article "The Evolution of Land Classification," my colleagues, E. N. Poulson and L. R. Swarner explained the early trail blazing which was done in working out the relation between land quality and reclamation feasibility, and how men of outstanding reclamation experience ascertained that, if irrigation is to succeed, the land must meet certain requirements. Naturally the degree of success, other things being equal, is in proportion to the increased quality of the land above these minimum requirements.

For instance, it was found in most areas that land with less than 18 inches of good free-working soil of a fine sandy loam texture or coarser was not likely to succeed under permanent irrigation farming. Lands with more than 12 percent slope are limited in crop adaptability, subject to erosion hazards and also present difficult production problems, and therefore are bad risks. Again, lands with high water tables are associated with limited crop adaptation, quality and yield, thus reducing their suitability for sustained, profitable farming. Lands affected with high water tables are also apt to go out of production because of "salting up." A set of these relationships has been worked out by the Bureau for the main land factors and are used as a general guide for the classification of the land. On each project, however, these relationships are refined, with the cooperation of the State agricultural colleges and the Department of Agriculture, to reflect specific local conditions.

Men familiar with the soil know that one set of specifications does not fit all conditions, and that modifications are necessary from project to project. The general specifications referred to do, however, form a solid foundation upon which to work, and keep the classifications throughout the Bureau uniform. Most important of all, they do represent years of experience.

(NEXT MONTH—HOW LAND IS SURVEYED)

THAT THE VALLEYS MAY PROSPER is the ultimate aim of the Northern Colorado Water Conservancy District. The Warburg cherry orchards and cornfields in the Big Thompson Valley, east of Loveland, Colo., are typical of the rich farming areas which are to receive water when they need it from the other side of the Divide. *Photo by N. T. Novitt, Region 7 photographer.*

How a Conservancy District Works

by J. M. DILLE, Secretary-Manager
Northern Colorado Water Conservancy District

Adapted from an address, January 17, 1952 during the Water Users Conference, at which the Four States Irrigation Council was organized at the Denver Federal Center, Denver, Colo.

Part 3—Managing the District

Under the terms of the contract with the Bureau of Reclamation, and the provisions of the conservancy district act, the district has worked out a water distribution program and repayment plan that will assure full and prompt repayment of construction charges and, we hope, will satisfactorily distribute the costs and benefits among the people of the district.

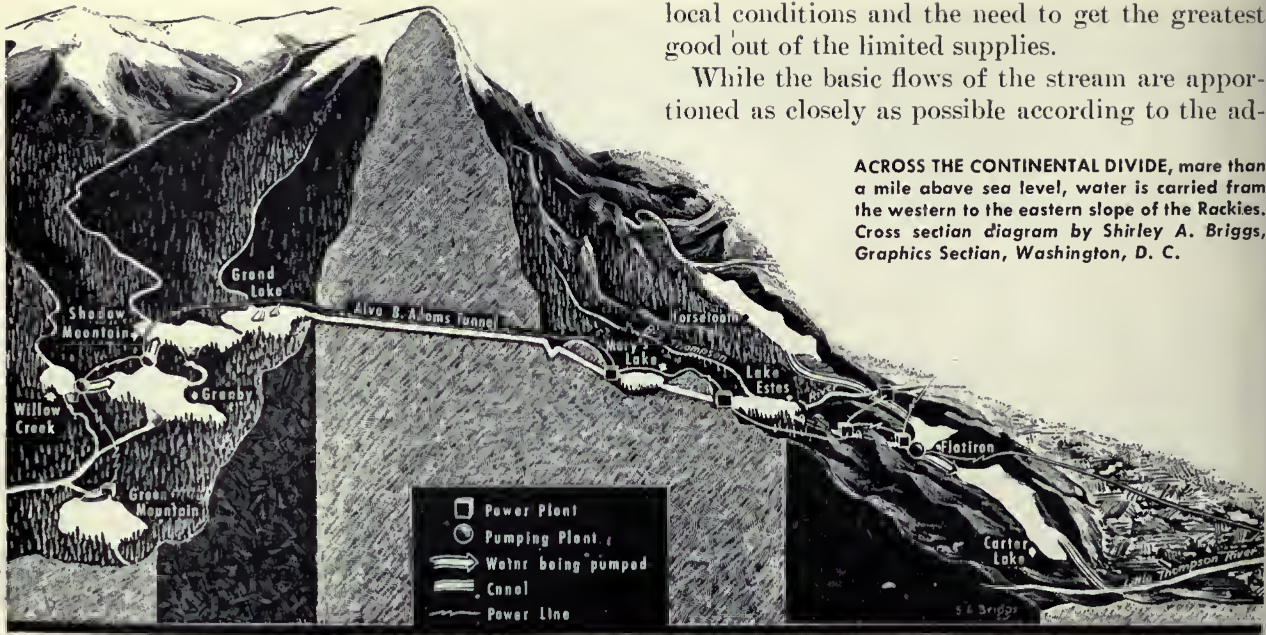
As previously stated, we expect to divert an average of 310,000 acre-feet of water per year from the Colorado River headwaters. Thus in our water user contracts, we define the acre-foot as being one three-hundred-ten-thousandth (1/310,000) of our annual supply. Most of the 310,000 acre-foot units of water have already been allotted by firm contracts at an annual assessment rate of $1.50 per acre-foot, a figure that the users decided they could pay.

Without going into detail, I may explain here that part of the project water is allotted to municipalities, part to several irrigation systems in blocks, but that most of it will be allotted to individual farms according to the petitions of the owners.

In order to properly control these individual allotments, the district has compiled a case history, as it might be called, of the present water supply of every farm in the area, based on the average water value of the stock, acreage, reservoir rights or pumping plants attached to the farm.

Allotment of water on the petition is thus usually limited to an amount that will total 2.5 acre-feet per acre, headgate diversion, including the present supply. This is done to prevent speculation and to spread the benefits as widely as possible.

There will probably be a total of about 2,700 separate allotment contracts when the water is all allotted. Each contract specifies the stream into which the allottee's water is to be delivered—the



ACROSS THE CONTINENTAL DIVIDE, more than a mile above sea level, water is carried from the western to the eastern slope of the Rockies. Cross section diagram by Shirley A. Briggs, Graphics Section, Washington, D. C.

Cache la Poudre, Big and Little Thompson and the St. Vrain Rivers.

From the point in the stream into which the district delivers the water, it will be the responsibility of the State officials and of the management of the system serving the allottee, to deliver the water to his land. The district has no desire nor in fact any authority to interfere on the streams or in the various distributing systems; but we are anxious to help set up a practical system that will assure the proper delivery of the water.

Of course the operation of all systems as far as diversion and delivery of water is concerned, is definitely tied in to the administration of the State engineer, the division engineer and the water commissioners in the several water districts. These officials distribute the daily flows of the streams according to the court decrees, supervise the transmission of reservoir and exchange water in the streams, inspect for safety the numerous reservoirs and keep records of all stream discharges and canal diversions.

It may be mentioned here that the distribution of stream flows, strictly in accordance with decrees, does not always provide the greatest beneficial use of our water supplies, largely because some owners of early appropriations are often inclined toward a "dog in the manger" attitude and use more than they actually need merely because they are legally entitled to it.

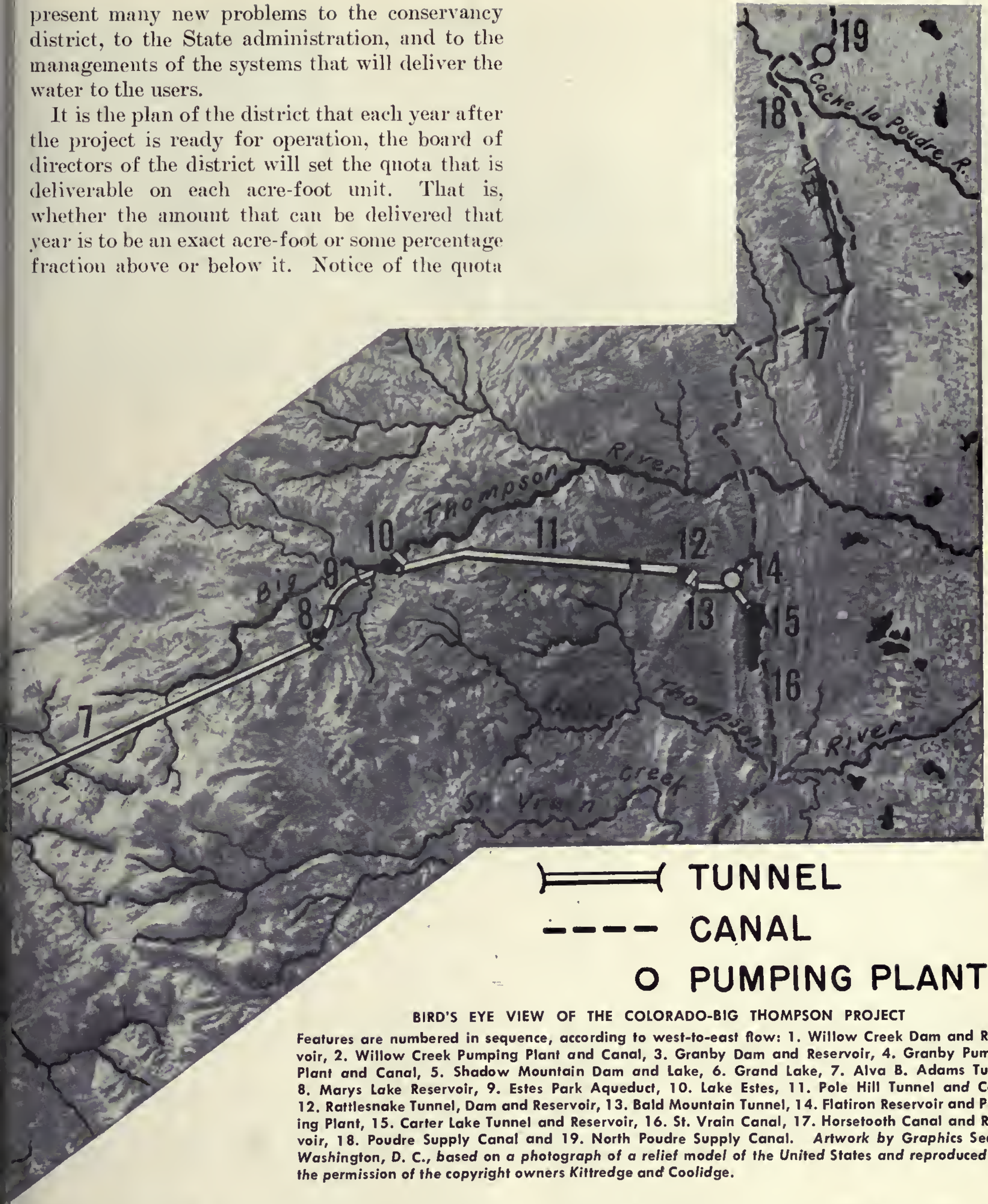
Over the years, the administration in the various water districts has also developed to fit the local conditions and the need to get the greatest good out of the limited supplies.

While the basic flows of the stream are apportioned as closely as possible according to the adjudicated decrees, the system of handling exchange water, reservoir flows, carriage losses, and the methods of operation and recording have been built up to suit local needs.

Consequently, it can be seen that the bringing in of around 300,000 acre-feet of new water will

present many new problems to the conservancy district, to the State administration, and to the managements of the systems that will deliver the water to the users.

It is the plan of the district that each year after the project is ready for operation, the board of directors of the district will set the quota that is deliverable on each acre-foot unit. That is, whether the amount that can be delivered that year is to be an exact acre-foot or some percentage fraction above or below it. Notice of the quota



BIRD'S EYE VIEW OF THE COLORADO-BIG THOMPSON PROJECT

Features are numbered in sequence, according to west-to-east flow: 1. Willow Creek Dam and Reservoir, 2. Willow Creek Pumping Plant and Canal, 3. Granby Dam and Reservoir, 4. Granby Pumping Plant and Canal, 5. Shadow Mountain Dam and Lake, 6. Grand Lake, 7. Alva B. Adams Tunnel, 8. Marys Lake Reservoir, 9. Estes Park Aqueduct, 10. Lake Estes, 11. Pole Hill Tunnel and Canal, 12. Rattlesnake Tunnel, Dam and Reservoir, 13. Bald Mountain Tunnel, 14. Flatiron Reservoir and Pumping Plant, 15. Carter Lake Tunnel and Reservoir, 16. St. Vrain Canal, 17. Horsetooth Canal and Reservoir, 18. Poudre Supply Canal and 19. North Poudre Supply Canal. ***Artwork by Graphics Section, Washington, D. C., based on a photograph of a relief model of the United States and reproduced with the permission of the copyright owners Kittredge and Coolidge.***

will be sent to each allottee and lists of the lands, the owners, and the attached quota under each ditch system will be furnished the management of the system and the responsible State officials.

A full program of necessary measurement stations and recording devices on west and east slope streams and project canals has been agreed upon by the State engineer, the conservancy district, and the Bureau of Reclamation. A special division engineer is now permanently located at Loveland

IN CONFERENCE with Mr. Robert S. Leighton, secretary-manager of the Pershing County Water Conservation District, managing farm operations on the ranch, or at home in Lovelock, Ruth Ruddell, typifies the modern women of the West. *Photos submitted through the courtesy of Robert S. Leighton, in photo at left.*

WOMEN OF THE WEST

The Lady President—Ruth Ruddell

SHE'S A LADY OF NO SMALL TALENTS. Ruth Ruddell, handsome, capable director, three times vice president, and twice president of the board of directors of the Pershing County Water Conservation District, is as much at ease presiding at a board meeting as she is doing the honors as a dinner hostess (for which she is noted) or inspecting beef cattle, bossing a fence repair job, or making a decision at a headgate regarding water deliveries on the Humboldt project in Nevada.

No wonder, for she was born on the ranch which she now operates, comes from a family which pioneered irrigation in the Lovelock Valley, and knows what she is doing. Although she handles several man-sized jobs, everyone agrees she's "quite a lady."

For years she helped her father run the farm, and upon his death she carried on in the family tradition, taking a lead in project affairs and operating the farm at a highly efficient level.

Miss Ruddell believes that women can play a big part in the success of irrigated farms by keeping up with all modern developments in irrigation farming. "Read," she says, and "take an active part in organizations dealing with farm activities."

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and plans are being developed for a more modern and adequate system of records and reports on stream flows and diversions in the water districts that will handle project water.

Here it might be mentioned that as the present original supplies are doubled by return flows and reuse, it is expected that the new water, about 40 percent of our present average original supply, will increase the return flows proportionately.

Under our repayment contract, this water is claimed by the United States for the use of the district which may recapture and use it or allocate it to ditches on the basis of their decreed priorities. For all practical purposes, it will become a part of the streams and subject to use by present appropriators.

Our repayment contract expressly gives preference to irrigation over power uses.

With increasing demand for power and multiplied administration and construction costs, perhaps this is unavoidable.

While our district directors take a keen interest in the power side of the project and the benefit it will also be to the area, they are not power people and are content to leave the decisions on power problems to others.

She herself was interested in the Pershing ounty Water Conservation District, first organ-ed as the Lovelock Irrigation District in 1926. he original organization was named for the city Lovelock which in turn was named after her andfather, George Lovelock, the original set-er in 1862 on the property which she now owns.

President Ruddell thinks that women should ke a more active part in district, community, and unty affairs as women are able to put more con-ntrated effort into public affairs which can be ell coordinated with the necessary assistance to e husband in his management of the farm.

Asked what were the most important qualifica-ons for membership on a board of directors, she id, "A good general knowledge of the district in gard to its functions and, particularly, its finan-al structure. But most important is a willing-ess to give considerable time to the duties of the oard for very little monetary compensation."

The most important aspect of Reclamation, cording to this experienced, thoughtful, farm-ette-executive, is the need for "more efficient use f our irrigation water, through improved irri-ation systems and methods."

She is an ardent conservationist and takes a een personal interest in new and improved ethods of weed control, irrigation, drainage, and rm management practices which add to the rtility and productivity of project lands. Her nstant aim is to increase the income and welfare f the water users and the project in general.

Seepage is one of the principal problems that ives her concern. Caused primarily by inade-uate distribution facilities and lack of a satisfactory drainage system, this problem has a more determined antagonist in Miss Ruddell. She has been very active and instrumental in obtaining the assistance of the Bureau of Reclamation in investigating and planning adequate distribution and drainage systems and in launching a water users program of drainage construction. Under her leadership, the district leased lands to provide summer pasture for livestock owned by the water users. Water users can thus carry more livestock of their own to utilize hay and grain otherwise consumed by transient livestock owned by non-project stockmen or exported to other areas. By feeding their own livestock rather than selling the forage, the water users boost their farm income and soil fertility.

All in all, the people of Lovelock have good reason to be proud of their third generation pioneer woman, and one of the very few lady presidents in the West. ###

EDITOR'S NOTE: With this issue the RECLAMATION ERA begins a series of articles on present-day pioneer women of the West. There are many unsung heroines on Reclamation projects today, whose experiences and observations can add new values to the store of knowledge regarding the winning of the West through wise conservation and use of water resources.

We hope our readers will contribute to this series. Send photographs, articles, or information to the RECLAMATION ERA, code 460, United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C. A free subscription for one year is awarded for each published article. Manuscripts should be submitted in duplicate, double spaced. Photos should be glossy prints, accompanied with description of topic, names of places, persons, name of photographer and date taken.

I think you would probably be interested to now that our relations with the multitudinous ersonnel of the Bureau have been most satisfac-ory and we have found these men, as a rule, capa-le and conscientious. If there is sometimes a gap etween the somewhat theoretical approach of the Bureau men and what we think is our more prac-ical slant on a mutual problem, we laboriously nd finally work out some agreeable solution.

It is now 16 years since the movement to get a etter water supply was started and about 13 years ince our district was organized and we made our ontract with the Government. We old-timers vonder if we will see the job completed. Never-heless, those of us who have been connected with the project since its inception in 1933, firmly believe that in spite of the years of delay, the increased cost, and all the other difficulties, the project is still a sound and justifiable undertaking.

We have a lot to learn yet, not only in the administration and management of our systems and water supplies, but most important, perhaps, in the application of water on our soils and crops. We can use too much water if we have it, or apply it, at the wrong time.

So we need careful thinking, more knowledge, plenty of hard work and all the mutual cooperation possible if the fullest use of the water supplies of Northern Colorado is to be eventually reached and we do our best in helping feed a hungry world.

The Valley of the Milk River

Part 3—Milk River Farmers

by PARKER E. HEIKES, Associate County Extension Agent, Malta, Montana

EDITOR'S NOTE: Although storage facilities on the Milk River project were filled during the Milk River floods in April, many of the farmers will face a water shortage due to damages to irrigation systems.

Many individual farm irrigation systems have been damaged almost beyond repair, while many acres of the most highly developed land has been rendered unproductive as a result of erosion or deposit by the flood waters.

Of the three water users referred to in this article, Bill Sudbrack has suffered the greatest loss. Land which he leveled last year for this year's crop must be releveled before it can be irrigated. His alfalfa and excellent pastures failed to withstand the prolonged inundation. He faces a big task in rehabilitating his land, and like many other water users with small acreages will be handicapped by lack of income since his only crop prospect will be feed grains.

Tom Simanton and Jim Sintler fortunately escaped the major flood and should produce a normal crop this year, due to repairs made on the Dodson South Canal.

ON THE MILK RIVER PROJECT, the man on the smaller irrigation farm plays an important, lasting and beneficial part in the ultimate development of the irrigated area.

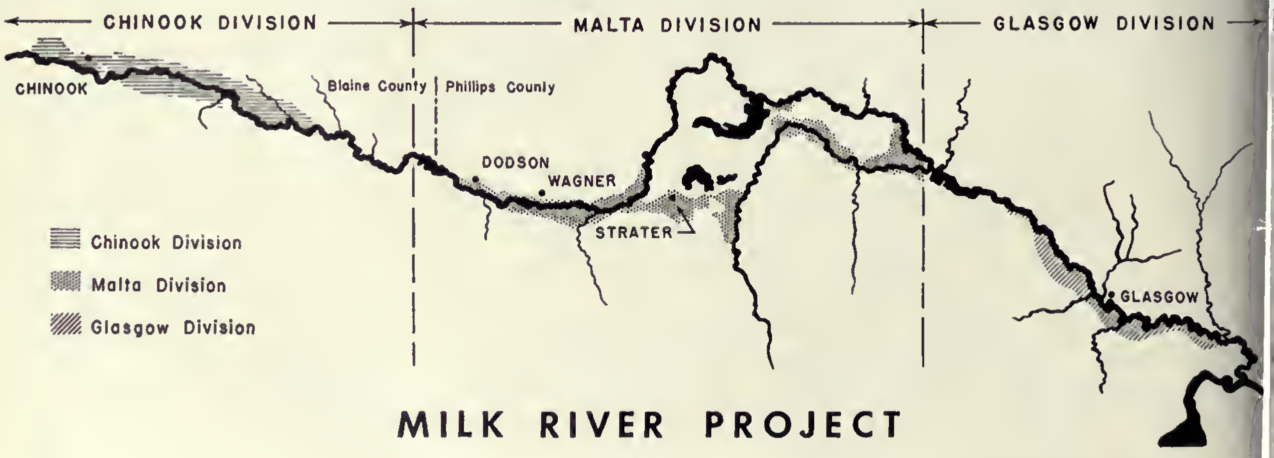
The success of the farmer on a small unit depends on how he handles his soil and water resources. In general he makes much better use of them than the large landowner.

Bill Sudbrack has been recognized for some time as one of the more progressive farmers on the Milk River project. He came to this country from Germany in 1923 and settled on his present farm in the South Wagner area in 1938. Since that time he has increased the value of his 99-acre farm from $6,600 to its present value of approximately $30,000. In addition Bill has two tractors, sugar beet equipment, potato equipment, and a general line of farm machinery which he values at $10,000. For the past 5 years his gross income has averaged $11,000 or more per year.

Bill follows a rather diversified type of farming. His crop rotation includes each year approximately 20 acres of sugar beets, 30 acres of alfalfa hay, 10 acres of feed grain, 4 acres of potatoes, and 17 acres of irrigated pasture. For 14 years, through proper soil management, liberal use of fertilizers, and general good farming, his sugar beets have average 15 tons per acre.

Bill has about 30 head of beef cows, and 15 dairy cows. In addition to the dairy products used in the home, he sells about $2,100 worth of milk and cream locally to the Malta Creamery. His 17 acres of irrigated pasture was seeded to a Huntley mixture at the rate of 10 pounds per acre, and usually is not irrigated more than twice during the season. He keeps 7 acres of this pasture for emergency but usually cuts it for hay. In the

WHERE THE MILK RIVER FLOWS—Three districts of the Milk River project use stored and diverted water to raise crops and livestock. Main irrigation structures of the Milk River project were shown on the map appearing on page 101 of the May 1952 Reclamation Era. ***Map below by Margery Updegraff, Washington, D. C., staff.***



MILK RIVER PROJECT

ASHOUT.—The John Hasler Farm in the South Wagner area er the April 1952 flood. The end of the farm ditch is the only rce of water for the north 60 acres of his farm. *Milk River* otos.

ERODED FIELD.—The Homer Lotton farm, near Dodson, after the flood. The field was leveled and developed for irrigation in August 1951 for about $100 an acre. It will cost about $50 more to get it back in condition.

rly spring when the growth is heaviest, he grazes e 30 beef cows and calves on the irrigated pasre until about May 10th. These are then turned to dry range land for the remainder of the ason, and the 15 dairy cows graze on the 10 acres ring the summer.

In Bill's opinion, the successful irrigated farm the Milk River project must have enough dry razing land, in addition to the irrigated, to andle 25 or 30 beef cows. Enough feed grain d hay should then be raised on the irrigated nd to winter the cows and fatten the calves that e to be sold. He believes too, that more emphas should be put on maintaining soil fertility, rough the rotation of crops and the use of maures and commercial fertilizers. Bill has very tle faith in dryland farming either as a means r a stable income, or as a supplement to the irriation farm income.

Anyone who thinks that farming does not reuire study and technical knowledge should talk Tom Simanton, one of the more successful rmers in the Strater area. Tom has proved at study of soil conditions and plant growth is ery important for the maintenance of high rop production and general successful irrigated rming.

Tom believes that soil temperature is quite imortant, both in the spring to obtain suitable crop tands and during the summer growing season or normal plant growth. For this reason he lows in the fall, to keep the soil porous, thus reucing deep frost penetration and helping the oil to warm earlier in the spring. He never irigates in the fall as he believes it makes the soil colder in the spring and delays spring germination. Tom sometimes waits until June for a sign of some weed growth, when he assumes that the soil is warm enough for seeding.

Tom's careful and intensive farming and his abundant use of manure and commercial fertilizers to maintain soil fertility have resulted in high crop yields.

In 1932, Tom had the highest tonnage per acre for sugar beets in the Chinook factory district—24 tons per acre. In 1948 a field of oats which had been fertilized with manure and phosphate produced 125 bushels per acre.

His usual production of high quality alfalfa hay is approximately 200 tons which he feeds on his own farm. During the past winter, he fed about 210 range cows, some of his own and some contracted. By marketing his feed through livestock, he estimates that he is selling his hay for approximately $40 per ton.

During the 1950 season, 6,505 acres were irrigated by private pumping systems on the Milk River project, which obtained water for irrigation both from the Milk River and Bureau of Reclamation canals. The farms irrigated by pumping averaged 91.61 acres, and grossed an average of $64.56 per acre.

Jim Sintler, who also lives in the Strater area, irrigates approximately 77 acres by using a 7½-horsepower three-phase electric motor driven vertical lift pump which delivers 1,500 gallons per minute. His power costs average approximately $1 per acre for the irrigation season.

Jim purchased his Strater area farm in 1943. The soil in this area is quite fertile, having a sandy

MAKING HAY on the Tom Simanton farm (at right). Each pile weighs about 700 pounds. Tom rakes it green to make it easy to stack and leaves it to cure, losing very few leaves. At lower right, pumping water to higher land on the Everett Boucher farm near Hinsdale, similar to Jim Sintler's irrigation methods. Below, siphon tubes are becoming popular on the Bill Sudbrack farm in the South Wagner area for irrigating row crops.

loam which responds well to irrigation. Most of the land was uneven and needed some leveling before efficient irrigation is possible. During May 1951, Jim leveled 11.6 acres, at a cost of $54.83 per acre, and seeded the field to oats and alfalfa.

His crop rotation is built around a combination of approximately 30 acres of alfalfa hay, 20 acres of feed grain, 22 acres of sugar beets, and 3 acres of irrigated pasture. For the past 5 years he has averaged 13.1 tons of sugar beets per acre. Jim also raises about 350 acres of dryland wheat in addition to his irrigated farm.

Jim believes that every irrigated farm in the Milk River area should center around some type of livestock feeding operation to use the feeds produced on the farm rather than selling them as a cash crop. As he believes every small farm needs a cash crop, Jim has always raised between 20 and 25 acres of sugar beets. He also uses sugar beets or some kind of row crop in his crop rotation to control weeds and to maintain soil fertility.

According to the 1950 project census, the average irrigable acreage per farm unit on the Milk River project was 181.03 acres. However, many of the large holdings are made up of temporarily suspended class 5 land which is quite low in productive capability. On the average farm, water was actually delivered to 86.21 irrigated acres. Most of the land on the smaller farm units is quite fertile and if managed, farmed and irrigated properly will produce enough for the average farm family to live comfortably. The average gross income in 1951, on 33 farms in Phillips County was $5,678. In addition, farmers on these units, which were developed by the Farmers Home Administration, either owned or leased 38.15 acres of dry crop land and 326.18 acres of dry grazing land.

Although farmers on the 80- or 100-acre farm units on the Milk River project do not produce the big gross income, the way they farm and build up the community is conducive to a permanent type of irrigated agriculture. The farmer on a small irrigated farm must be an excellent judge of market trends, weather conditions, soil and plant relationships, the irrigation requirements of various soils and plants and of general soil fertility and its maintenance, if his farm is to be a permanent source of income. ###

HAVE YOU CHANGED YOUR ADDRESS LATELY? GOING TO MOVE SOON?

Let us know immediately so we can change our mailing list—it takes time, you know.

We'll do our best to deliver the RECLAMATION ERA at your door, but we have to know where it is.

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C. PETRUS PETERSON

(Continued from page 163)

ly, the Supreme Court of Nebraska decided in vor of the complainant on the basis of an inter- etation of what constitutes a "watershed."

Engineers hastily surveyed the disputed table nds to see in which direction the water would n, if there were any water to run. The net sult is that on one side of the road the water is pposed to run to the Platte, and on the other le of the road it is supposed to run to the Re- iblican. To the eye of the bystander there ap- ars no difference except the abundance of the ops on the irrigated or so-called "Platte River ainage" side.

Water, or the lack of it, makes for fights. This as no exception. Tempers rose, and the dispute rried through the entire season of the unicameral gislature until the problem was passed on to the gislative council for "study," thus enabling the nbattled legislature to adjourn.

Senator Peterson, then serving as chairman of ie banking, commerce, and insurance committee, as chosen to take over this hot potato for the mple reason that he lived outside of the disputed rea, and had taken no part in the legislative fight!

If the legislators had hoped to bury the ques- on, they reckoned without the chairman. He ok the issue directly to the people, and set up ie first series of legislative council hearings iroughout the State where people who could therwise not afford to come to the State capitol ere enabled to appear before the committee.

For over a year these hearings were held. The ieetings were jammed with emotional people. Engineers with charts and dissertations got up nd talked endlessly about why the water could r could not be put on this or that side of the oad. Lawyers supported them with long cita- ions as to why the water should or should not e put on this or that farm. It was all very un- onvincing to the dried-out farmer on the table and. It was just as unconvincing to the farmer n the Platte Valley in whose memory the drought ears were still vivid. He felt that his birthright vas being argued away. All the time three mil- ion acre-feet of water were flowing out of the nouth of the Platte River every year. "Surely," aid Senator Peterson, "sensible people can arrive t a better solution than this."

During that year the senator worked harder than he did when he worked his way through college. He read stacks of books, listened to hundreds of people. Week-ends and evenings were spent studying. When the final report of the legislative subcommittee was drafted, there was attached to it an impressive bibilography. The odd part about it was that Senator Peterson had actually read it. The report was accepted unanimously by the legislative council. In effect, the report recommended that the lands of the Platte Valley be developed first. If subsequent study indicated that enough water was available, it could be used outside the watershed. The unicameral legislature, however, has never passed a diversion bill.

Still unsatisfied, he took to the road. A most accomplished speaker, he took every opportunity to talk about water. Few maps of the Missouri Basin had yet been printed. The senator provided himself with some yard-square sheets of paper and a map stand, and sketched off the location of the rivers and the irrigable land, as any chalk artist might do. He carried so much paraphernalia to meetings that he jokingly said all he needed to be a pack mule was long ears.

When reclamation leaders sought to create a Nebraska Reclamation Association, it was Senator Peterson who was asked to present the motion to create such a body. This he did in January of 1944, before an irrigation meeting called by the Omaha Chamber of Commerce. It had been a dry, windy fall, and fear of another drought hung heavy on the State. Over 600 people packed the hall the day the association was born.

Senator Peterson went on the board of the newly formed association in 1945, and became its second president in 1946, serving for 2 years.

After this he became the Nebraska Director of the National Reclamation Association, served as Treasurer for 1950, and last fall he was elected president at the annual meeting in Amarillo, Tex.

Senator Peterson is an ardent supporter of a program to develop the maximum amount of hydroelectric energy in connection with water storage projects. He does not believe in the exclusion of private power companies. He believes in "private business," says he wants more "private business," but that the way to get it is to have all the power both private and public resources can produce.

In his own State, he is known as the "Great

Compromiser," not of principle, but of detail. He maintains that all life and particularly all legislation is a matter of compromise. "We are all selfish," says the senator, "and public welfare is the combined selfishness of the greatest number."

This, then, is the man who now heads the National Reclamation Association. He lives with his wife, Vera, in a new ranch-style house at 1909 South Thirty-third, in Lincoln, Nebr. He is the father of three brilliant daughters, Breta (Mrs. David Dow of Lincoln), Vera Mae (Mrs. Bertrand Mitchell of Houston, Tex.), and Patty (Mrs. Robert Larson of Wichita, Kans.). Each daughter has two children.

To quote a legislative reporter in the unicameral legislature one day, "Senator Peterson looks and acts like a United States Senator ought to!" ###

Salt Lake Pipeline Payment Breaks Precedent

Recently the Metropolitan Water District of Salt Lake City, Utah, made its first annual payment of $310,000 on the Salt Lake Aqueduct, and new terminal reservoir, to the Bureau of Reclamation, boosting the district's total payments to date on the aqueduct division of the Provo River Project to more than $500,000. The district made a voluntary advance payment of $200,000 last summer, believed to be without precedent in Reclamation history (see article entitled, "The Salt Lake Aqueduct," on page 12, January 1952 Reclamation Era).

KEEPING AHEAD.—J. A. Nelson (at right) water district controller, hands over the $310,000 payment on the Utah water project to Ernest O. Larson, Bureau of Reclamation Regional Director at Salt Lake City, Utah. Lane W. Adams, water district treasurer at center.

During a brief ceremony in Salt Lake City at the Bureau's office, J. A. Nelson, water district controller said, "Without the water supply made available by these works, there could be no increase of industry and population in the community, nor could the present population be supported in security."

Mr. Ernest O. Larson, Regional Director of the Bureau, representing the Secretary of the Interior, received the check and said, "This shows the results of excellent cooperation between the people and the Government in getting a job done that was large enough to require Government help and yet necessary for future growth and security of the area. It also signifies the fact that reclamation projects are 100 percent repayable under reclamation law." He further pointed out that the Salt Lake aqueduct represents the first instance wherein a municipality has participated to such a large extent in making a Federal Reclamation project possible, and paid special tribute to members of the water district's board of directors. (Photograph of members of the board appears on page 45 of the February 1952 issue.) •

Corbin Named Boulder City Manager

Secretary of the Interior Oscar L. Chapman appointed Harold N. Corbin, former City Manager of Porterville, Calif., to the position of City Manager at Boulder City, Nev., early in April this year.

Under this arrangement Boulder City, a Federal Government town since 1931, will become a self-governed community, incorporated under the laws of the State of Nevada. Secretary Chapman initiated the action for changing the status of the town in July 1951. First municipal elections in the city's history were held in November 1951, when residents voted on a special committee to make recommendations regarding election of the city manager. They also voted for representatives on an advisory council to assist the city manager in administration of municipal affairs.

The city manager will develop a municipal organization and devise a city budget, accounting and operating procedures, and arrange for the transfer of utilities, facilities, shops, and properties from the Boulder Canyon project to the municipal administration. •

olden Anniversary Tree Grows at Nation's Capitol

An American Elm, carefully selected from the issouri River basin, was dedicated and presented the United States, to commemorate Reclama-n's Golden Jubilee year, by the Greater North ikota Association on April 29, 1952.

The Reclamation tree replaces the famous eorge Washington Elm which was removed 2 ars ago, having exceeded the usual 125-year life an of its species.

Henry H. Westlie, president of the GNDA, ened and presided over the presentation cere-nies, stating that it was a rare occasion and eat privilege for a private citizen from an out-ing State to preside at a function in the National ipitol Grounds. He introduced executive secre-ry Leroy Pease who stated that North Dakota, common with 17 Western States, has especial asons for marking the golden anniversary of clamation, among them the fact that Henry Clay ansbrough, a North Dakota Senator, was one of c sponsors of the Relamation Act, and Theodore oosevelt, who signed the act was at one time resident of North Dakota. Mr. Pease said, Roosevelt was a firm believer in the conservation water, soils, and forests. His talks, writings, id messages were largely responsible for the rly conservation and reclamation legislation hich was approved by the National Congress. eclamation has meant more to the national econ-ny than all of California's gold, Colorado's silver id Arizona's copper. It is appropriate there-re, that North Dakota commemorate this golden iniversary of reclamation so as to properly pay ibute to the great leaders who brought this legis-tion into being."

Assistant Commissioner Goodrich W. Line-eaver represented the Bureau of Reclamation iring the ceremony, terming it "an occasion of eat significance in the history of Reclamation." e said, "From the time Senator Hansbrough be-ime instrumental in the founding of Reclama-n, North Dakota and reclamation have made eat progress, and will continue to do so as long we have such support and hearty cooperation evidenced in the pleasant observance here day."

Mr. W. A. Fredericks, architect and horticul-irist, represented Mr. David Lynn, the architect r the Capitol, and accepted the tree on behalf of the Government. He stated that the George Washington Elm had been one of the largest and most magnificent trees on the Capitol grounds, measuring 5½ feet in diameter at the base. He expressed the hope that the Reclamation tree would grow to the might and majesty of its illustrious predecessor.

AT DEDICATION CEREMONIES Leroy W. Pease, executive secretary (at left), and Henry H. Westlie, president of the Greater North Dakota Association, turn the first shovelsful of earth. From left to right: United States Representative Fred G. Aandahl of North Dakota; Mrs. Aandahl; Pershing Boe, administrative assistant to Senator Young; R. J. Hughes, past president, GNDA; United States Senator Milton R. Young; Frederick J. Frederickson, GNDA; Patricia M. Byrne, personal secretary to Senator Young; Edward D. Frye, assistant to Representative Aandahl; Mrs. Fred J. Frederickson; F. A. Irish, treasurer, GNDA; Louise Finke, secretary to Representative Aandahl; Becky Bergesen, assistant secretary to Representative Aandahl, and Ruth F. Sadler, editor, Reclamation Era. *Photo by Abbie Rowe—Courtesy National Park Service.*

Climaxing the ceremony, officials of the GNDA, Senator Milton R. Young, Representative Fred G. Aandahl, members of their staff, and Assistant Commissioner Goodrich W. Lineweaver, shoveled earth around the roots of the tree, signifying its acceptance, the culmination of its 1,600-mile journey from 2 miles south of Mandan, N. Dak., and the fact that it could now take root in the Capitol grounds. •

WATER REPORT

By the first of June, the possibility of serious floods over most of the West had faded. Run-off was high in Utah and Nevada with accompanying damage, largely in the vicinity of Salt Lake City, Utah, but in the northwest, conditions were such that melting was orderly with no major floods developing. This was also the case in the Colorado River basin and other western basins. The discharge of the Rio Grande at Albuquerque, N. Mex., has not exceeded 10,000 c. f. s. and probably will not exceed that amount. This is a disappointment to those anticipating high run-off to Elephant Butte Reservoir.

Almost without exception run-off, as reported by the Geological Survey, was normal or better during May. The exception was south central Texas where the drought continues. Run-off was well above average in most of California, Arizona, and Idaho, over all of Utah and Nevada and from part of Oregon, Montana, Wyoming, Colorado, New Mexico, North and South Dakota, Nebraska, and Kansas.

Reservoir storage was most satisfactory. Shasta Reservoir filled for the first time. Salt River project storage was much above average as was the case with storage for the North Platte and Kendrick projects. Much project storage was being filled as flood threats receded and flood control space became less necessary. Except for the Carlsbad project and possibly the Rio Grande project the situation looks good.

A résumé of the outlook by regions as of the first of June follows:

Region 1.—Water supply for Bureau projects uniformly good or better. Reservoirs which had been drawn down for flood control were filling. Storage in Lake Roosevelt increased over 1,000,000 acre feet. Filling dead storage at Potholes Reservoir began.

Region 2.—There was spill from both Millerton and Shasta Lakes as run-off continued above normal. Shasta filled during May and storage increased at Millerton. Storage in Upper Klamath Lake largest in last 10 years. Seasonal inflow to Orland project reservoirs continued to be above normal with reservoirs full.

Region 3.—Storage in Lake Mead increased almost 3.5 million acre feet during the month with basin precipitation subnormal during May. Salt River project reservoirs continued to gain storage. Storage largest since 1943 and considerably above average.

Region 4.—Outlook for water very good or better over whole of region. Where possible, reservoirs were operated for control of flood run-off during May.

Region 5.—Only W. C. Austin project had favorable outlook. Tucumcari supply adequate but storage was lowest since 1941. Rio Grande project had 339,000 acre feet in storage but Rio Grande run-off was disappointingly low. Outlook for Carlsbad project was poor with only about 21,000 acre feet in storage.

Region 6.—Outlook for water very good throughout region. Storage will be above normal with exception of Keyhole Reservoir.

Region 7.—Water supply of region was uniformly excellent. Storage for North Platte and Kendrick project much above average and reservoirs may spill. ●

CROPS

Coachella Tomatoes Peak Crop

Tomatoes on the Coachella Division of the All-American Canal project in California had an average per acre value of $2,500 in 1951 as compared with $2,234 in 1950. This looms as the most valuable crop grown on Bureau projects as the annual crop report nears completion. During 1951 tomatoes valued at $2,167,500 were grown on 867 acres as compared with $1,052,081 worth grown on 471 acres in 1950. ●

LETTERS

Thank You, CB&Q!

Chicago, Burlington & Quincy Railroad Co. Traffic Department,
2004 Farnam Street,
Omaha, Nebr.

May 14, 1952.

Dear Mrs. Sadler: Thank you very much for the marked copy of the Reclamation Era, March 1952, reporting the Water Users Conference or Four States Irrigation Council, held in Denver, on January 16–17, 1952.

I enjoyed the meeting immensely [cut off] feel it was one of the most construct[cut off] sessions of its kind that I have b[cut off] privileged to attend.

This department is a long-time, [cut off] voted reader of the Era. I wouldn't [cut off] surprised if we have one of the m[cut off] complete files of the publication am[cut off] your subscribers. Much credit goes [cut off] you for the excellence of the magaz[cut off]

Sincerely,

Val Kuska,

Agricultural Development Agen[cut off]

Reclamation and Human Welf[cut off]

Dr. Wilbur L. Powers, consult[cut off] engineer in Athens, Greece, for[cut off] head of the soils department at W[cut off]ington State College, sent us the foll[cut off]ing transcript of some remarks he m[cut off] recently at a dinner in Athens, wh[cut off] we are reprinting here as a matte[cut off] interest to our readers, and as p[cut off] of the widespread concern regar[cut off] soil, water, and reclamation. I[cut off]dentally Dr. Powers is now on his [cut off] to Baghdad, Iraq, where he will [cut off]doubtedly continue his efforts in be[cut off] of peaceful development of the wor[cut off] natural resources.

"Soil and water are the two g[cut off] renewable natural resources. [cut off] mines may be dug out and the for[cut off] depleted or cut down, yet the iner[cut off]ing populations must continue to [cut off] fed, and the world's land surface [cut off] less than 30 inches annual preci[cut off]tion, which, especially in the war[cut off] climates, is very unevenly distrib[cut off] So it is the mission of reclamation [cut off] to help liberate our lands from f[cut off] erosion and drought. This is in [cut off] with the declared policy of the U[cut off] Nations. If for two or three dec[cut off] resources and skills could be devot[cut off] peaceful development the people c[cut off] be largely relieved from hunger [cut off] want.

"The reclaimable lands and u[cut off] water resources are mainly locat[cut off] young alluvial valley and delta a[cut off] These are the deep, permeable, [cut off] leached, and fertile soils that can, [cut off] developed, supply the mineral rich [cut off]min carrying food stuffs needed.

"Back of our daily bread is the [cut off] and it comes from the soil. The [cut off] has supported and must contin[cut off] rt all life. It is a basis of value t is not readily carried away or ed up.

he water is a daily need of almost living thing. It is the "white- that yields hydroelectric power t the load from labor's back.

eclamation and good, soil-conserva- practices make the least amount nd sufficient for the support of one ly, a condition that makes for peace security."

ongratulations from the NRA

ngratulations to whomever de- s the credit for getting "The Four s Irrigation Council" together in er January 16 and 17, as written n the Reclamation Era for March ages 66 and 67. From the stand- t of public relations, it seems to his is one of the best things ever .

Sincerely,

WILLIAM E. WELSH,
Secretary-Manager.
tional Reclamation Association

gion 7 officials in Denver say the r users deserve the credit. So— a bow!—Ed.

Gophers Get Around

BRIDGEPORT, NEBR.,

EAR SIR: In two separate publica- s of the RECLAMATION ERA within ast year there were articles relative pher control using cyanide gas. I ed my copies to another farmer, and n turn to another, so that by now we unable to locate the gopher poison- articles.

ould you please, if it is possible, me duplicate copies of the "ERA" aining the cyanide gas-gopher con- articles.

Sincerely,

EDWIN S. KIMMEL.

e are glad to send the extra copies, if information like this is worth a r to your farmer friends, perhaps would like to make sure of having r own copies and getting similar rmation by subscribing to the 1.—Ed.

RELEASES

lamation in the United States

lfred R. Golzé, Director of Programs Finance, Bureau of Reclamation, authored a recent book entitled clamation in the United States," as t of McGraw-Hill's Civil Engineering Series. This volume, of approximately 480 pages, profusely illustrated with photographs, charts, and graphs, was designed to provide material for college courses in engineering and economics relating to reclamation and to provide reference material for research or review of the reclamation programs of the United States.

Of particular interest to water users are the chapters on land settlement, operation and maintenance policies and procedures, and a factual account of the repayment laws and procedures from 1902 to the present.

Director Golzé has covered the past, present, and future of Reclamation, starting with the ancient Mesopotamian Code of Khammurabi and concluding with a chapter of multipurpose operation and river regulation in the western United States. The book covers, in an easy-to-read and comprehensive manner, the policies, procedures, and practices of the Bureau of Reclamation; the laws, lands, investments, returns, administration, and economics of the Reclamation program, and explains the evolution of the program to the present time and its relationships with other Federal, State, county, and private organizations.

The book can be purchased for $8 at bookstores or from McGraw-Hill Book Co., 330 West Forty-second Street, New York 36, New York.

"Water in the West" Goes Global

The Bureau of Reclamation film "Water in the West" has been selected by the State Department to represent U. S. Government documentary films at the Edinburgh Film Festival, the principal international annual film competition.

This film had previously been selected as a United States entry at the International film competition held in Bombay in February.

Films from some 30 nations will compete for the prizes at Edinburgh. A preliminary competition will be held in London this summer, with a second elimination competition to be held in Edinburgh. Only films which survive these two eliminations will be shown at the Festival itself between August 17 through September 7.

Sixteen millimeter prints may be borrowed for noncommercial showing free of charge by writing to the Commissioner's office or any Regional Reclamation office, the borrower to pay shipping charges both ways.

Reclamation Street—26,000 Miles Long

This illustrated multilithed publication contains a first-hand account of the Commissioner's observation on Asian irrigation and power programs and a map insert delineating his inspection tour of India, Pakistan, Thailand, and many other areas which required him to travel the 26,000 miles mentioned in the title. The May and June 1951 issues of the RECLAMATION ERA carried a condensed version of this tour under the same title. Copies of the more detailed 50-page account may be obtained free of charge by writing to the Bureau of Reclamation, United States Department of the Interior, Washington 25, D. C.

New South American Periodical

The other day we received from our good friend Dr. Luis J. Medina (see article entitled, "Two-Way Street" on p. 78 of the April 1951 issue) a handsome new periodical entitled, "Agronomia Tropical." It is issued quarterly, contains about 98 pages with numerous illustrations, and can be obtained at a subscription rate of $6 a year.

Those who read Spanish and are interested enough in South American irrigation and agricultural methods to wish to subscribe should write to the Instituto Nacional de Agricultura, Maracay, Venezuela.

New Livestock Films

"Cattle Country" and "Western Sheep" are the titles of two new 16-millimeter technicolored films with sound tracks showing the latest developments in livestock management in the West, including range management, ranch layout, disease prevention, and handling for market.

For information about obtaining these films for showing at schools, colleges, meetings, and other gatherings, write to Joe W. Jarvis, Supervisor of Agricultural Development, Union Pacific Railroad Co., 1416 Dodge Street, Omaha 2, Nebr. The films run about a half hour each.

NOTES FOR CONTRACTORS

CONTRACTS AWARDED DURING MAY 1952

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Cont amo
DS-3641	Missouri River Basin, S. Dak.	May 16	One 115,000-volt circuit breaker for Watertown substation, schedule 4.	Pacific Oerlikon Co., Tacoma, Wash.	$2
DS-3645	do	do	One 115,000-volt and one 69,000-volt circuit breaker for Huron substation, schedules 4 and 5.	Pacific Oerlikon Co., Tacoma, Wash.	3
DS-3651	do	do	Two 115,000-volt circuit breakers for Sioux Falls substation, schedule 3.	Pacific Oerlikon Co., Tacoma, Wash.	4
DS-3659	Colorado-Big Thompson, Colo.	May 1	One 7,500/9,375-kilovolt-ampere autotransformer with 6 lightning arresters for Beaver Creek substation, schedule 1.	Moloney Electric Co., St. Louis, Mo.	4
DS-3659	do	May 2	One 115,000-volt circuit breaker for Beaver Creek substation, schedule 2.	Allis-Chalmers Mfg. Co., Denver, Colo.	2
DS-3659	do	May 8	One 46,000-volt circuit breaker for Beaver Creek substation, schedule 3.	Pacific Oerlikon Co., Tacoma, Wash.	1
DS-3667	Davis Dam, Ariz.-Nev.	May 27	3 lots of supervisory control and telemetering equipment for E.D. 2, E.D. 4, and Coolidge substations.	Westinghouse Electric Corp., Denver, Colo.	1
DS-3671	Kendrick, Wyo.	May 2	One 1,000-kilovolt-ampere station-service unit substation for Alcoa power plant, item 1.	I-T-E Circuit Breaker Co., Philadelphia, Pa.	2
DS-3676	Eklutna, Alaska	May 5	One 40-ton travelling crane for Eklutna power plant	Ederer Engineering Co., Seattle, Wash.	3
DS-3677	Missouri River Basin, S. Dak.	May 29	One 2,800-kilovolt-ampere, one 1,200-kilovolt-ampere, and one 600-kilovolt-ampere deicing transformers for Fort Randall switchyard, schedule 1.	Queensboro Transformer and Machinery Corp., Crystal Springs, Miss.	2
DC-3680	Missouri River Basin, Nebr.-Kans.	May 9	Construction of earthwork, concrete canal lining, and structures for Courtland canal, schedule 5.	J. A. Terteling and Sons, Inc., Boise, Idaho	1,42
DS-3684	Colorado-Big Thompson, Colo.	May 2	2 controls for 84-inch butterfly valves for Flatiron power and pumping plant.	Rucker Co., Oakland, Calif.	1
DS-3685	Columbia Basin, Wash.	May 23	4 horizontal-shaft centrifugal-type pumping units for PE-51, PE-56, and PE-60 pumping plants, Area P-8, Potholes East canal laterals, items 1 and 3.	Food Machinery and Chemical Corp., Los Angeles, Calif.	2
DS-3688	Eklutna, Alaska	May 2	2 vertical-gate-shaft-type governors for regulating speed of two 25,000-horsepower hydraulic turbines for Eklutna power plant.	Woodward Governor Co., Rockford, Ill.	5
DS-3689	Cachuma, Calif.	May 9	2 lots of chlorination equipment for Ortega and Carpinteria control stations, South Coast conduit.	Everson Mfg. Corp., Chicago, Ill.	1
DC-3691	Colorado-Big Thompson, Colo.	do	Completion of Pole Hill power plant and switchyard and Flatiron power and pumping plant and switchyard, and installation of equipment in Carter Lake pressure tunnel valve shaft, Estes Park-Foothills power aqueduct.	Eagle Erection Co., Shoshoni, Wyo.	1,
DS-3694	Eklutna, Alaska	May 13	One switchgear assembly for Eklutna power plant	General Electric Co., Denver, Colo.	[illegible]
DS-3697	Central Valley, Calif.	May 22	Two 9,400-horsepower vertical-shaft hydraulic turbines for Nimbus power plant.	S. Morgan Smith Co., York, Pa.	4
DS-3699	Kendrick, Wyo.	May 29	One main control board extension, one graphic and auxiliary control board, and one telemetering receiver-watt recorder for Alcova power plant.	E. A. Pedersen Co., Omaha, Nebr.	[illegible]
DC-3701	Columbia Basin, Wash.	May 20	Construction of earthwork, pipelines, and structures for area W-8 laterals, sublaterals, and wasteways, West canal laterals.	Otis Williams and Co., Helena, Mont.	5
DS-3703	Central Valley, Calif.	May 29	One 12,500/16,667-kilovolt-ampere transformer for Nimbus switchyard.	Pennsylvania Transformer Co., Canonsburg, Pa.	[illegible]
DS-3705	Colorado-Big Thompson, Colo.	do	1 main control board and 1 annunciator cabinet for Pole Hill power plant, schedule 1.	Wolfe and Mann Mfg. Co., Baltimore, Md.	[illegible]
DS-3705	do	do	1 supervisory control and telemetering board, 1 supervisory control and telemetering panel, and 1 lot of carrier transmitting and 1 lot of carrier receiving equipment for Pole Hill power plant, schedule 2.	Control Corporation, Minneapolis, Minn.	2
100C-141	Boise, Idaho	May 21	Construction of 3 residences and garages	Hairl Bivins, Caldwell, Idaho	[illegible]
100C-142	Palisades, Idaho	May 12	Grading and utilities for community facilities at Palisades	Brennan Construction Co., Pocatello, Idaho.	[illegible]
117C-141	Columbia Basin, Wash.	May 13	Street lighting and power and control cable installations	Coulee Dam Electrical & Repair, Coulee Dam, Wash.	[illegible]
600C-91	Missouri River Basin, N. Dak.	May 14	Custer Trail and Devaul substations	Northolt Electric Co., Grand Forks, N. Dak.	[illegible]
604C-26	Missouri River Basin, Mont.	May 8	Clearing areas 7, 8, 9, and 10, Canyon Ferry Reservoir	Pennington Constr. Co., Ft. Collins, Colo.	[illegible]
703C-238	Missouri River Basin, Colo.	May 28	Construction of Julesburg substation	George W. Shelp, Rawlins, Wyo.	[illegible]
703C-243	Kendrick, Wyo.	May 27	Oil handling equipment at New Casper substation	Landon Construction Co., Casper, Wyo.	[illegible]
701C-244	Missouri River Basin, Nebr.	May 21	Partial demolition of Consumers[8] Public Power district, diversion dam, relocation of Lost Creek and removal of timber bridge.	Winslow Constr. Co., Englewood, Colo.	[illegible]
701C-245	Missouri River Basin, Colo.-Nebr.	May 20	Exploratory ground water wells and test holes, Frenchman Creek Basin.	Layne-Western Co., Omaha, Nebr.	[illegible]
701C-247	Missouri River Basin, Colo.-Kans.	May 9	Miscellaneous protective works and river control section for Bonny Dam.	Cass Co., Contractors, Ogolala, Nebr.	[illegible]

Construction and Materials for which Bids Will Be Requested by September 1952

Project	Description of work or material
ma, Calif.	Construction of 500- by 280-foot concrete-lined Ortega reservoir located north of Summerland, Calif.; 340-foot square concrete-lined Carpinteria reservoir located northeast of Carpinteria; 18- by 49-foot reinforced concrete control station buildings, and chlorination houses; and installation of chlorination equipment, 30- and 24-inch steel pipe and 1,400 feet of 30-, 24-, and 18-inch concrete pipe.
al Valley, Calif.	Furnishing and erecting antenna tower and mounting antenna, constructing concrete block radio hutment, and installing standby gasoline motor-driven generator for station at Mt. Vaca.
o	Extension of Ivanhoe irrigation district laterals on the Friant-Kern canal distribution system near Ivanhoe, Calif., involves excavating and backfilling 4.8 miles of pipe trenches; furnishing and laying 3.8 miles of 12- and 15-inch concrete irrigation pipe; and laying 1 mile of 12-inch Government furnished concrete irrigation pipe.
o	Eighteen 40- by 24-foot radial gates and 75,000-pound hoists for Nimbus Dam.
o	Six 10.5- by 12.07-foot fixed wheel gates, frames, and accessories for Nimbus power plant.
o	One indoor, 5,000-volt, 1,200-ampere, metal-clad switchgear assembly for Nimbus power plant.
o	One 480-volt unit substation for Nimbus power plant.
o	One 7,500/9,375-kilovolt-ampere, 13.8-kilovolt to 4,160-volt, 3-phase transformer for Folsom switchyard.
do-Big Thompson, .	Construction of a 200-foot inlet structure for Aspen Creek siphon, including installing a 20-foot Parshall flume, breaking into present inlet structure and installing 4- by 4-foot gate, 5 miles southwest of Estes Park, Colo.
bia Basin, Wash.	Construction of the Othello development farm about 10 miles southeast of Othello, Wash. Work consists of 1 three-bedroom frame residence and 4 frame buildings, septic tank, water mains, walks, and gravel driveway.
e	One 600-volt station-service control center for Babcock pumping plant.
Dam, Ariz.	115-kilovolt switching equipment for ED-5 substation.
o	Three 10,000/13,333-kilovolt-ampere, 154/34.5/4-kilovolt, single-phase power transformers for Gila substation.
o	One 28,667/35,833-kilovolt-ampere, 230/115/12.5-kilovolt, 3-phase, power transformer and one 25,000-kilovolt-ampere, 115-kilovolt, 3-phase, regulating transformer for Prescott substation.
Kendrick, Wyo.	Extension of lateral No. 256, including furnishing and laying 1,000 feet of 18-inch precast-concrete pipe, constructing 6,000 feet of extension to open lateral, and constructing a wasteway structure 4 miles Southwest of Casper, Wyo.
Middle Rio Grande, N. M.	Excavation and improvement of 17 miles of Rio Grande drainage and conveyance channel and levee from San Marcial, N. Mex., to channel headworks.
Missouri River Basin, Kans.-Neb.	Erection of antenna towers, construction of buildings and modification of existing buildings for establishment of a Kansas River District radio communication system.
Missouri River Basin, Mont.	Completion of Canyon Ferry dam and power plant, consisting of installing embedded and nonembedded parts of three 23,500-horsepower turbines and three 16,667-kilovolt-ampere generators; miscellaneous metalwork, architectural finishes, and electrical equipment in power plant, erecting switchyard steel and installing equipment on roof of power plant; and constructing elevator tower on dam.
Missouri River Basin, S. Dak.	Distribution boards and battery chargers for temporary Oahe substation.
Missouri River Basin, Wyo.	Installation of 115-kilovolt circuit breaker and related switching equipment and steel supports for the Lovell-Thermopolis bay in the Thermopolis substation, and installation of drainage system for the control building at Thermopolis, Wyo.
Provo River, Utah	Placing 26,000 cubic yards of riprap on unprotected sections of river banks along 10-mile reach of Provo River channel above Deer Creek reservoir, about 13 miles northeast of Provo, Utah.
Riverton, Wyo.	Construction of concrete drop structure and two control structures in Wyoming canal's Cottonwood drain to control maximum runoff to 110 cubic feet per second capacity.
San Diego Aqueduct, Calif.	Construction of 31 miles of 95 cubic feet per second capacity San Diego aqueduct's second pipeline from Hemet, Calif., to Rainbow, Calif., near San Diego, parallel to the present aqueduct between San Jacinto regulating reservoir near Hemet and the San Vicente reservoir near San Diego. Work consists of furnishing and laying 9 miles of 75-inch, 14.5 miles of 60-inch, and 7.4 miles of 48-inch inside diameter precast-concrete pressure pipe; constructing incidental structures; and installing meter, valves, power-operated gate, and small piping. About 700,000 cubic yards of excavation are involved. The 75-inch diameter pipe is to be noncylinder, the 60- and 48-inch, noncylinder and cylinder.

United States Department of the Interior, Oscar L. Chapman, Secretary

BUREAU OF RECLAMATION OFFICES

Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

Commissioner's Staff

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Assistant Commissioner	Goodrich W. Lineweaver
Assistant Commissioner	Kenneth Markwell
Assistant Commissioner	Harvey F. McPhail
Assistant to the Commissioner—Engineering	T. W. Mermel
Assistant to the Commissioner—Management Planning	G. S. Ellsworth
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Director, Supply Division	S. W. Crosthwait
District Manager, Alaska District Office, Juneau, Alaska	Joseph M. Morgan

REGIONAL OFFICES

REGION 1: Harold T. Nelson, Regional Director, Box 937, Reclamation Building, Fairgrounds, Boise, Idaho.
REGION 2: R. L. Boke, Regional Director, Box 2511, Old Post Office Building, Sacramento 10, Calif.
REGION 3: E. A. Moritz, Regional Director, Administration Building, Boulder City, Nev.
REGION 4: E. O. Larson, Regional Director, 32 Exchange Place, P. O. Box 360, Salt Lake City 8, Utah.
REGION 5: H. E. Robbins, Regional Director, P. O. Box 1609, Old Post Office Building, 7th and Taylor, Amarillo, Tex
REGION 6: K. F. Vernon, Regional Director, P. O. Box 2130, Billings, Mont.
REGION 7: Avery A. Batson, Regional Director, Building 46, Denver Federal Center, Denver, Colo.

U. S. GOVERNMENT PRINTING OFFICE: 1952

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THE RECLAMATION AREA

The Reclamation ERA

August

1952

Official Publication of the Bureau of Reclamation

The Reclamation ERA

Reclamation's Golden Jubilee
1902-1952

August 1952
Volume 38, No. 8

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The printing of this publication has been approved by the Director of the Bureau of the Budget, May 25, 1950.

CONTENTS

FEATURE ARTICLES

SHORT FEATURES

Ruth F. Sadler, *Editor*

Subscription rate $1.50 a year for persons residing in the United States and Canada; $2 a year for foreign subscriptions; special rate of $1 a year for members of water users' associations, and Bureau of Reclamation employees. No stamps, please!

OUR FRONT COVER

"But don't go near the water"

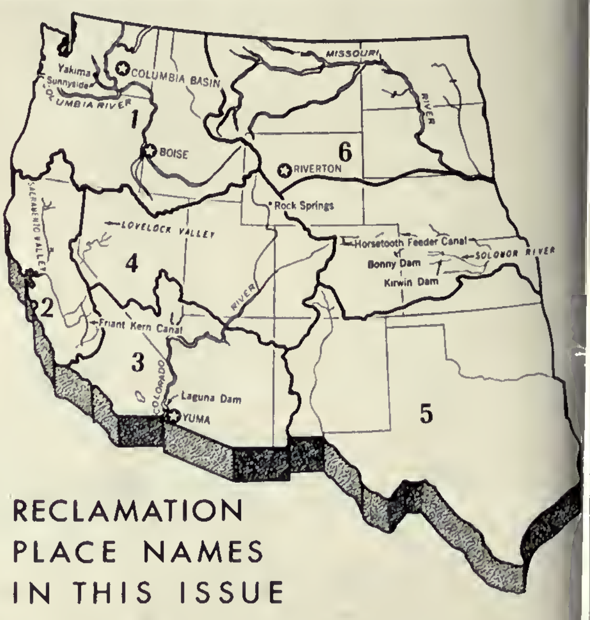
Here is a use for irrigation water on the Belle Fourche project in South Dakota that does not appear on the water user's contract. The young fry had better read Sam Larsen's story on the next page to understand why the project superintendent frowns on this practice.

35 YEARS AGO IN THE ERA

PLAYGROUNDS ON RECLAMATION PROJECTS

On many of our projects opportunity for rest and recreation is offered by the natural and artificial lakes which serve as reservoirs for conserving the floods. The creation of these storage basins by the construction of huge dams in canyons and natural depressions has produced a number of beautiful and charming lakes, the utilization of which is becoming more general each year by the farmers and town folks. In some cases these resorts already have attained a national reputation and are visited by tourists from all parts of the country.

(From an article by C. J. Blanchard, statistician, on page 375 of the August 1917 issue of the Reclamation Record, predecessor to the Reclamation Era).



RECLAMATION PLACE NAMES IN THIS ISSUE

by S. T. LARSEN, Operation and Maintenance
[L]iaison Representative, Design and Construction
Division, Denver, Colo.

LOOKS SAFE?—Even in this peaceful, Boise, Idaho, setting lurks the ever-present danger of deep water, although there are no structures nearby. ***Photo by B. D. Glaha, Region 2 photographer.***

"YOUR HUSBAND HAS JUST DROWNED in the canal!" Would you, Mr. Wateruser, want your wife to [r]eceive such a message? Let us hope that she [ne]ver does. But that's the kind of message which [M]rs. Reuben Younkin, wife of a settler on the [Bu]reau of Reclamation's Riverton project in [W]yoming, received one day last summer.

The Younkins, Mr. and Mrs. and their two [yo]ung sons, moved to the Riverton project in [Ma]rch 1950, after Mr. Younkin had been awarded [a h]omestead in the drawing for veterans. They [im]mediately set to work at the almost discour[ag]ing task of making a farm and home out of a [pi]ece of raw land. Their first year's work on their [ho]mestead saw them rewarded with a good crop [an]d a modest home and they were full of plans [an]d hopes for the future.

But in one moment of unwariness the brightest prospects can be dashed to bits. Mr. Younkin was not willfully negligent. Like many others he just did not realize the hazards which existed. By pointing out some of the dangers lying in wait for the unwary, in and about irrigation canals, we may reduce the number of accidents and the attendant suffering. This article, the first of three on canal safety, takes up the risk of swimming in canals.

On July 18, 1951, Mr. and Mrs. Younkin had been to Riverton and were a little late in getting back home for the bountiful noon meal Mrs. Younkin's mother had prepared. As the meal was about over, we can visualize a neighbor dropping in, mopping his face and neck.

BEWARE OF THE VACUUM!—At left, note the rectangular opening in front of the pipes. When water in Colorado-Big Thompson' Horsetooth Feeder Canal rises above normal, the siphon spillwo goes into automatic operation, and a vacuum, strong enough t suck a man into the spillway, is created. Above, current around check structures (like this one on the Sunnyside Canal Yakima project, Wash.) are extremely dangerous. *Photo at lef by A. E. Thompson, above by S. T. Larsen.*

"Boy, is this day a scorcher—what I wouldn't give for a good swim about now!"

"You've sure come to the right place," said Reuben, "I was just thinking myself how good that water would feel. I should irrigate my alfalfa this afternoon but I can still get that done if we go right away and make it a quick one. It's only a couple of miles to a swell place up on the canal where I used to go swimming last summer. The water is good and deep for diving."

"Well, what are we waiting for?"

And so the two friends were off.

The "swimming hole" to which they proceeded was the back water above a check chute structure on the Wyoming canal, which is quite large at this point. During the preceding summer, however, there had not been much water flowing through the canal because only a few of the new farm units were being irrigated. What the men failed to realize was that now, even though the pond above the check looked about the same as it had a year earlier, the volume of water moving through the canal had been increased several-fold, and as a consequence some very strong currents were moving near the check.

Mr. Younkin was caught in one of these currents. In spite of being a strong swimmer, he was swept through the check opening.

He caught hold of the structure as his friend rushed to help him. But the force of the water was too great—it swept him down the chute to the stilling pool. There his body was recovere some hours later.

There has been a lot of speculation as to wha might have contributed to the tragedy and wha might have been done to have prevented its los sorrow, and hardship. Some think that Mr Younkin may have been seized with a cramp tha prevented him from saving himself. Whether o not that is true, we do know that currents nea structures are often so strong that it is useless fo any man caught in them to struggle against them If the canal bank had been posted with "No Swim ming" signs it is quite likely, in this case at leas the drowning might have been prevented. Whil the posting of canal banks is an important part o any safety system, this in itself is no guarant of prevention of accidents. Because no norm person wants to drown, we feel that the sure way to prevent such accidents is to educate th people of the community to appreciate the ver real dangers in wait for anyone venturing int an irrigation canal.

Most drownings on irrigation systems have bee due largely to the fact that the victim was ignora of the dangers. On another project, four peop drowned together by being swept into an aut matic siphon spillway, a structure designed t protect a canal from washouts by removing a l of water in a hurry when the water surface of th canal rises above a certain level. The victi were swimming near the siphon without havi least idea of how dangerous it was. The water rface rose enough to cause the siphon spillway go into operation suddenly, sucking up a large lume of water from the canal and discharging down the wasteway. Probably never knowing hat force hit them, the swimmers were pulled o the siphon by the current and lost their lives. this case, there were "No Swimming" signs the canal bank but the combination of desert at and the enticing water overcame any qualms conscience these people might have had er breaking a Government "No Swimming" gulation.

Another place of great unsuspected danger for e inexperienced person on irrigation systems is e concrete lined canal. The sides do not look ry steep, nor does the water look very deep the novice who wants to get across. If he is so olish as to try such a crossing, he finds that he trapped by deep water and wet concrete sides slippery as glass. If he is lucky enough to ach an escape ladder in time, he may get out ive. But the chances are against him.

Knowing of the existence of all of these hazards the public, and we have mentioned just a few, e Bureau of Reclamation is trying first of all educate the public in recognizing the dangers herent in all irrigation systems. To that end esentations are being made through the press, dio and schools. We want the people to realize that we are not being merely officious in forbidding them the use of canals as swimming holes, but are primarily interested in their safety and welfare.

Knowing that educational programs alone are not enough, we have been installing heavy fencing around the most dangerous locations to make it very difficult for any person to get himself into trouble. We have also installed signs warning of specific, as well as general, dangers.

Since there will always be those who manage to get into trouble in spite of what others may do to keep them out, we have placed numerous escape devices such as escape ladders, safety nets, safety floats, grab lines, etc. in our canals, particularly near dangerous structures. These devices will be described and illustrated in a subsequent article.

We find that the likelihood of accidents increases with the increase in size and depth of the canals, with the increase in the number of structures and with the increase in density of population. Consequently we go to the greatest lengths in the installation of safety devices in those places where we feel that the likelihood of accidents is greatest. In spite of all we can do, the safety of any person is pretty much in his own hands. So the next hot day when you are "simply dying" for a swim in the canal, don't do it. STAY ALIVE BY STAYING OUT.

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U CAN'T CLIMB A CANAL BANK LIKE THIS ONE!—Frank yon's 12-year-old son shows how impossible it is to save urself from this situation. *Friant-Kern Canal, Central Valley oject photo by C. Kepner.*

WHERE YOUNKIN DROWNED.—The upstream end of the stilling pool on the Riverton project in Wyoming into which Reuben Younkin was swept and drowned. Concrete baffles increased the hazard of turbulent water. *Photo by S. T. Larsen.*

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YUMA POWER WAGON

by HARRY S. RIDDELL, Project Manager, Yuma County Water Users' Association, Yuma, Ariz.

REPAIR SHOP ON WHEELS.—At left, lifting a gate assembly with power hoist, before placing it in concrete takeout. Above, Sam (at right) and his helper loading the gate.

WE CALL IT "SAM'S POWER WAGON."

In reality, it is a standard power wagon, incorporating ideas of our shop crew, and operated by Sam Neahr, heavy duty field mechanic. This power wagon is a complete mobile machine shop, used for all sorts of trouble shooting in addition to the regular work of installing gates and gate frames in concrete checks and turnouts.

This mobile machine shop is powered by a 110-volt power plant, used principally in running a one-fourth horse power drill and grinding machine. It is also equipped with an acetylene torch, a winch on the front end used in connection with a boom, an A frame over the body of the car supporting a traveling crane, a combination vise and drill, drums of welding gas and a number of tool boxes with tools of every description. A spare tire is carried on top of the A frame.

Farm turnouts and lateral checks on this project are poured in steel forms developed by the Bureau of Reclamation. When the water users took over the operation of the Valley Division of the Yuma project from the Bureau of Reclamation on July 1, 1951, a supply of check and turnout forms were turned over with other equipment. A regular construction crew pours these concrete structures and later strips the forms. As soon as the forms are stripped, Sam appears with his power wagon and backs up to the new gate and gate frames already hauled to the job or, in some cases, he lifts it from the bed of the power wagon with his chain hoist.

Once the gate is hanging from his overhead carrier which extends out over the back of the power wagon, the wagon is backed up to the structures and the gate and frame lowered into the well of the turnout or check. If the terrain is such that the power wagon cannot get close enough to the structure to place the gate with the chain hoist, the boom is taken from the A frame where it is carried and assembled on the front end of the power wagon. With the winch on the front end, the gate assembly is hoisted and swung in place. After the gate is in the well, the torch comes into play to enlarge any holes in the frame that do not fit over the receiving bolts in the concrete well face. If new holes are needed in the gate frame, the electric drill is put into use. Possibly the gate does not fit snugly on the gate seat at some point. If the seat is low, it is built up with the welding torch and dressed down with the power grinder. If a spot is high, it is ground down to grade. The gate or gate seat is ground and buffed until it is a perfect fit.

After the gate frame is securely bolted and concrete is plastered around the frame to make a tight joint, the job is complete except for putting a lock nut and washer on the gate stem so the gate cannot be forced past center of the closing point on the gate seat. After the gate is properly seated and centered, the extra gate stem above the gate wheel is cut off at the top of the wheel and a washer slipped over the stub. The ga em is then drilled, the hole threaded and a wash-ed lock nut is screwed in the end of the stem. his construction will not permit the gate stem to lowered through the gate wheel and the gate annot go past the center line of the gate seat. will, however, allow the gate to be raised. In is manner, the gate can never go below center nd no amount of pressure on the wheel will bow e stem and pry the gate away from the frame.

In operating the gates, sticks or debris may nter the gate, causing it to leak. If the person perating the gate happens to be anyone other an the zanjero (ditchrider), or another experi-nced operator, it will be his natural instinct to ut more force on the wheel. This causes even reater leakage. The gate cannot close any tighter n account of the obstruction, so something has to ive. It is usually the gate stem—as more force is applied, it buckles away from the face of the concrete and slants the gate away from the gate seat. When the obstruction is finally removed, the stem has obtained a perpetual bend. One of Sam's jobs is to take off such a gate and stem, straighten the stem, rerun the threads and replace the gate with Sam's device that permits the gate to be lowered only to the proper elevation. The lock nut instead of the gate stem withstands any additional strain.

With his power wagon, Sam can go anywhere at anytime, on-load all his supplies and equipment up to two and a half tons per unit, off-load at the job site and make all necessary repairs. Many times, it is cheaper and more efficient to haul heavy equipment and parts in trucks to be delivered at the site but, if necessary, Sam's power wagon can pick up, deliver and install. ###

SAM NEAHR—HEAVY DUTY MECHANIC.—Sam wastes neither time nor motion. At upper left, he is oiling the dinky engine used to haul riprap for Laguna Dam. Sam started as a pipe fitter and fireman, but shortly thereafter became a locomotive engineer, even though under age, when he proved his superiority over a certain self-styled engineer who ran the dinky through a trestle and piled it into a hole. Sam continued as a locomotive engineer until 1935. Arrow points to Sam (above) before one of the 60-ton engines used to haul riprap for the Colorado River levee. Sam saved the Government so much time and money through his efficiency on this job that he was given right-of-way over the other trains and engineers. Between 1935 and 1951, Sam was chief plumber, machine shop worker, and heavy duty mechanic for the Bureau. At left, Sam, near the door of his power wagon, talking to his helper, as he continues to serve the water users.

SAM NEAHR, born in Yuma, Ariz., in 1891, s a natural-born engineer, mechanic and efficiency xpert.

During his 44 years with the Bureau of Recla-nation, he has handled everything from a 60-ton ocomotive to a water faucet.

He started work at the age of 15 for his father vho managed the Government grocery store at the ite of Laguna Dam. He then worked for the J. G. White Co., until the Reclamation Service took over the job in 1907 and Sam started to work for the Government. In 1951 he retired on a pension, but not from work. Without losing a shift, he went to work as a heavy duty mechanic for the Yuma County Water User's Association where he now operates the Yuma power wagon, along with other jobs. He is a man who is happy in his work and looking forward to many more years of usefulness. •

STRETCHING SHORT WATER

by FELIX KARRER, Farm Power Advisor, Sacramento Municipal Utility District, Sacramento, Calif.

FELIX KARRER, author of the accompanying article, for which the photos were submitted through the courtesy of the Sacramento Municipal Utility District, California.

> Agriculture in Sacramento County is a $50,000,000 business, a major source of income to our population. For this reason its problems are important to the entire community. Water, and its availability for irrigation, are of critical importance, and the slow but regular decline of the water table in this area is a matter of real concern. Under present conditions, the re-use of waste water is important from a conservation standpoint, entirely aside from its economic advantage to individual farmers, and the publication of this study should be a valuable contribution to the public welfare.
>
> Very truly yours,
>
> RAY C. GEIBERGER,
> *Sacramento County Farm Advisor,*
> *Agricultural Extension Service.*

WATER HAS BEEN CALLED THE LIFEBLOOD of California agriculture. Certainly the availability of water, and the cost of distributing this water, are major factors affecting farm production and profits.

In the area served by the Sacramento Municipal Utility District, the recirculation of runoff or waste water [1] has become important both as a means of conserving water and of reducing irrigation costs.

In most cases, water can be recirculated at substantially lower cost per acre-foot than the original cost of pumping it from the ground. The lift is small compared to the average well lift. Power costs are generally lower, as is the initial investment required for the low-lift pump installation as compared to the cost of a well pump of corresponding capacity.

Such recirculation systems operate in one of three ways:

(1) Pumping from a low-end collecting basin into a "high-line" ditch.

(2) Pumping from a drainage cut back to the main ditch.

(3) Pumping from a low-end collecting basin into the main pipeline system.

Regardless of the method used, the recirculation of waste water brings a number of benefits in addition to the cost-advantage previously mentioned.

These are:

(1) WEED CONTROL. Standing water on pasture land encourages objectionable water grass and plant infestation which will displace good pasture grasses.

(2) MOSQUITO CONTROL. Standing water quickly becomes the breeding ground of mosqui-

[1] RIGHT TO THE USE OF WASTE WATER.—A farmer in California has the right to re-use the waste water from his own land, provided the water is recovered before it leaves his property. Questions concerning the right to the use of waste water occurring in California natural channels or drains should be referred to the State Division of Water Resources, Public Works Building, Sacramento.

PUMPING FROM COLLECTING BASIN to high-line ditch. Photo at left, long shot; at center, closeup. Photo at right, the ditch end of this operation.

OM DRAIN TO MAIN DITCH.—At mediate right, water is pumped to the main ditch. At far right, the ain ditch, with water that is going be used over again.

FROM COLLECTING BASIN TO PIPE LINE SYSTEM.—At lower left, a long shot, and at center a close up of the motor and pump. At lower right, an example of how drainage leaves ladino pasture practically free from weeds.

TEST RESULTS OF 8 RECIRCULATION PUMPS

Pump No.	Motor hp	Type [1] pump	Head in ft. water to water	Capacity, gallons per minute	Effic. in percent wire to water	Kwh/ac ft. low lift plant	Kwh/ac ft. reg. well plant	Initial invest. low lift plant (approx.)	Initial invest. reg. well plant (approx.)
1	½	P	1.5	285	18	8.7	80	$250	$1,000
2	40	C	19.7	4,500	50	41.5	80	1,500	----------
3	5	P	3.7	1,940	35	10.9	80	1,000	2,500
4	5	C	9.0	475	22	42.0	115	200	1,400
5	3	C	4.6	115	3.5	126.0	113	250	900
6	5	C	9.7	350	12	82.0	160	50	1,200
7	5	C	6.7	470	12	55.2	109	50	1,400
8	7½	P	5.5	3,350	39	14.4	80	1,200	----------

[1] P—denotes propeller pump.
C—denotes centrifugal pump.

REMARKS:

1. Pumps Nos. 2 and 4 are centrifugal pumps V-belt driven. These are the only centrifugal installations where an attempt was made to fit the pump to the specific pumping condition by decreasing the rotative speed through proper pulley diameters. By this means the maximum efficiency of the pump is realized under a head condition similar to that encountered in the field.

2. Pumps Nos. 5, 6, and 7 are direct connected centrifugal pumps, the latter two previously used in lifting against a head of 40 to 50 feet. This explains the low efficiency of 12 percent for the low lift application, since no attempt was made to reduce the speed. Pump No. 5 was a new pump, but was designed for a head condition of 110 feet. The corresponding low efficiency of 3½ percent is proof of the misapplication of this otherwise efficient unit. Recirculated water in this case is more expensive in kilowatt hours per acre foot than is the water pumped from the well, even though the respective lifts are 4.6 feet and 60 feet.

3. The three propeller pumps operated against very low heads, and with the exception of pump No. 1, the velocities in the discharge pipe were high. Since the velocity head was not credited to the pump in the calculations, the efficiency of these units is less than normal. Propeller pumps, or high specific speed pumps, are to be recommended for low-lift applications because of their high efficiency in handling large volumes of water against low heads.

4. Pumps Nos. 6 and 7 are driven by 5 horsepower three-phase motors. Many such units became available when, due to the dropping water table, deep well turbines were installed in the irrigation wells. This explains their low cost in this area.

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toes. Aside from the human element, mosquitoes will plague livestock, in time reducing their production.

(3) Road protection. Standing water can, by means of underground percolation, soften roadbeds to the point where expensive repairs are necessary.

(4) Flood control. When drainage ditches are inadequate, recirculation may prevent the flooding of the farmer's own or neighboring fields. Such flooding has resulted in several law suits in the Sacramento Municipal Utility District area.

The choice between the three general types of recirculation systems will obviously depend on local conditions. Where a pipeline can be installed economically, recirculation and distribution by this means eliminates the maintenance of ditches and drainage cuts.

In planning any system, it is particularly important that the amount of available water be carefully estimated, and the capacity of the pumping plant determined accordingly.

It is equally important that the pumping plant be selected, or modified, to handle the low-lift assignment efficiently. The tabulation above gives the performance, cost, and efficiency-ratings on eight installations in this area. The wide variation in efficiency (from 3½% to 50%) is explained in the accompanying remarks. It will be obvious that substantial savings can be realized from the modification of centrifugal pumps when they are to be used in recirculation systems.

Information and specific data can be obtained from pump dealers, from the Agricultural Extension Service, or from the Utility District.

The district fully recognizes agriculture's important contribution to the economic welfare of the Sacramento area, and has, in addition to the advisory services made available to all customers, provided special services to its rural customers. The planning of recirculation systems comes in this category.

Adapted from the pamphlet entitled, "The Use of Waste Water for Irrigation" and reprinted through the courtesy of the Sacramento Municipal Utility District.

RUTH BUDD, PRESIDENT of the ???

LAURA COCHRANE, SECRETARY-TREASURER of the ???

WOMEN OF THE WEST

A Reclamation Role for Wyoming Women

y RUTH BUDD, President, newly formed, as-yet-nnamed, Women's Auxiliary of the Wyoming eclamation Association

Some people may think that Reclamation is urely a man's business, without interest for wom-n. As the wife of a cattle rancher who has erved two terms as president of the Wyoming eclamation Association and on interstate com-act commissions, I have attended enough meet-igs with him to find myself definitely interested Reclamation and its vital problems and implica-ons for the West. There are plenty of other omen similarly interested.

The idea of forming a women's auxiliary of the Vyoming Reclamation Association was presented everal years ago. No action was taken, however, ntil last fall when the State Association presi-ent, Mr. Breck Moran, of Cody, put the sugges-on in motion and the women's auxiliary of the Vyoming Reclamation Association was organized

PRESIDENT'S MESSAGE

As president of the Wyoming Reclamation Association, I am most grateful to our ladies for their interest and work in founding a women's auxiliary. May it grow and prosper!

It is, after all, appropriate that the first women's auxiliary of a State reclamation association should arise in Wyoming. It was in Wyoming that women first achieved the franchise; first elected a woman State governor.

There is good reason behind such developments, for it is on the frontier rather than in settled civilizations that the capabilities of women and their contributions stand out most clearly and unmistakably.

Mrs. Joe Budd of Big Piney, our auxiliary's first president and author of the accompanying article, Mrs. Ben Cochrane of Lander, its first secretary-treasurer, and the other women who formed our auxiliary, have started something. I am confident that their organization and work will contribute vigorously to the progress of Reclamation.

Breck Moran, President,
Wyoming Reclamation Association.

during the convention in Rock Springs, Wyo., on October 1, 1951.

For many years the Wyoming Reclamation Association had been considered a man's organization, even though wives of the members had always been included in the invitations and notices of meetings. In recent years, the number of women accompanying their husbands to these meetings had been increasing, and it was thought the time had arrived to plan an active organization for the ladies, in conjunction with regular meetings.

Accordingly, a luncheon was planned for the women who had accompanied their husbands to the Rock Springs convention. At this luncheon the women's auxiliary was born.

The women present elected Mrs. Ben Cochrane of Lander, wife of the Fremont County State association director, as secretary-treasurer. They honored me by electing me president. The organization was formed in a temporary fashion to await more complete organization this fall at the 1952 State Reclamation Association convention at Wheatland. At this time we plan to draw up and adopt a constitution and bylaws.

We decided the auxiliary should be primarily a social group to promote a more consistent attendance for the association as a whole, and to furnish entertainment and social activities for those ladies who find it enjoyable to attend the meetings with their husbands.

Aside from the social angle, however, there are other good and, in my opinion, more important reasons why women should be encouraged to attend the sessions of the Reclamation Association.

Only by means of meetings where ideas on regional and local problems can be discussed, ex changed and argued can development take plac There the reports should not be limited to the ea of men alone, for a conversational knowledge the problems at hand can do much toward assurin a friendly and close family relationship. An why should not a wife acquaint herself with th plans and projects which affect her future as we as her husband's?

All of us have worked at some time or anothe with church groups, community clubs and civi organizations to raise money to improve ou schools, churches, libraries and medical services— thinking first of our children. We wish to su port the Reclamation movement for the same re sons. For, in the actual progress of Reclamatio women and children are the principals who wi actually be the most benefited.

Reclamation projects, whether they be on large or small scale, will promote the growth any community, because more land brought und cultivation means more families on the land an more townspeople to serve them. Greater pr ductivity of the land means higher tax valuation and, as a result, better schools, churches, hospita and roads. Such community progress tends t ward a better rounded social and cultural lif more and better opportunities for children ar adults alike—in short, better homes with clos family ties.

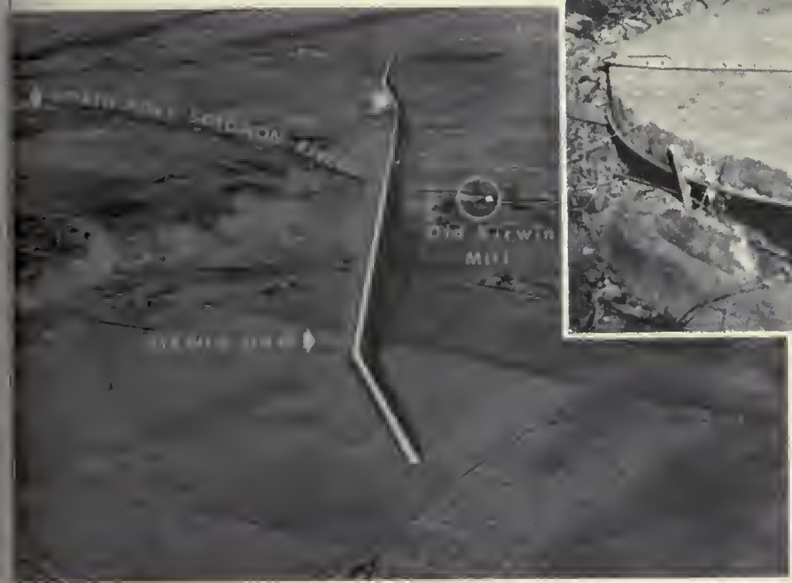
Because Reclamation holds an interest for bo men and women, the joint attendance at Recl mation meetings can be prompted by the wome desire to attend, which is often the determini factor for the attendance of the men. Besid there is no easier way to form or renew acquai ances across the State, for a convention makes f a friendly relationship between the wide a varied interests of the State.

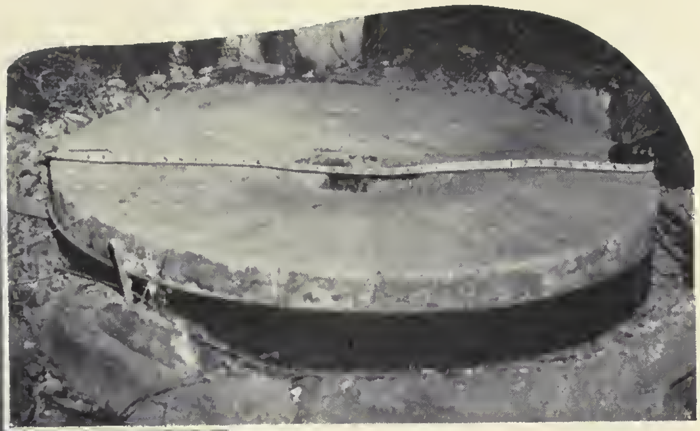
And that is one of the reasons why the name f our women's auxiliary has been left undecid though a few facetious names have been sugges by the men, such as Weeping Willows, Wa Witches, and Water Lilies.

The contest opens the doorway to a larger tendance, which is one purpose of our organi tion. It is our fervent hope that enough inter is created in this year's convention so that women's auxiliary will become a potent factor furthering the aims of Reclamation in Wyoming. ##

TEN DOLLARS for a Title for The Ladies!

FOR WOMEN ONLY.—Send your suggestions for appropriate names for this newly formed woman's organization to Earl T. Bower, second vice president and Wyoming director of the National Reclamation Association, Worland, Wyo., who is arranging a contest to select a name for this group at the annual State meeting in Wheatland in September. Mr. Bower is furnishing the prize money, $10, to the person who suggests the name selected. All entries must be postmarked no later than midnight August 31, 1952. The contest is limited to residents of Wyoming.





TWO SYMBOLS OF PROSPERITY—The gristwheel of the past (above) and the dam of the present (at left). ***Both photos by John N. Berg, Region 7 photographer. Artwork at left by Washington, D. C., Graphics Section, based on artist's conception of dam by M. H. Willson, Denver Federal Center, Denver, Colo.***

KIRWIN at the CROSSROADS

by GLENN E. THOMAS, Office Engineer, Kirwin Dam, Kans.

Solomon River, in Northwestern Kansas, is going back to work again.

On March 27, 1952, the people of the Solomon Valley flocked to Kirwin, where an old mill symbolizes an early era of prosperity due to water-resource development, to watch the start of a new job for the Solomon River, the beginning of Kirwin Dam.

Kirwin, Kans., was once the center of a busy trading area in the valley due to a large on-the-farm population which made good use of the river's water resources for turning grist mills to grind the farmers' grain. It has been off the beaten track for many years, a quiet village whose many empty business buildings and homes, and the crumbling foundations of buildings long since gone, gave mute evidence of its prosperous past.

One of the town's remaining citizens, John M. Gray, a former merchant, banker, surveyor, and State senator, looked to the Solomon River to bring greater prosperity to the farmers in the valley again and new life to the towns along its banks. Largely through his efforts, a movement was started to interest the Bureau of Reclamation in investigating the irrigation possibilities of the Solomon Valley.

Then came the disastrous floods of 1951, resulting in more than $16,000,000 damages in the Solomon River Basin and much greater losses in areas farther downstream—Topeka, Kansas City, and St. Louis.

As a result of this emergency, and previous investigations made of the area, in November 1951, the Congress of the United States made funds available to start building Kirwin Dam—one of the trio of flood barriers on the Solomon River. Kirwin Dam on the North Fork, Webster on the South Fork, and Glen Elder on the main stem, were authorized under the Flood Control Act of 1944 as part of the Missouri River basin project.

During its heyday, Kirwin had 3 churches, a school, an opera house, 5 hotels, 2 restaurants, 4 livery stables, 2 banks, 2 printing houses, a slaughterhouse, brewery, flour mill, and about 30 other establishments where people could buy or sell dry goods, groceries, hats, boots, shoes, furniture, drugs, lumber, and hardware. Kirwin became the site of a Federal land office, adding to its popularity as a place where pioneers could get the latest news on homesteads, or settle matters about land claims.

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The Atchinson & Denver Railroad, now known as the Central branch of the Missouri Pacific, reached Kirwin about 1879, increasing the town's importance as a center of activity in the upper Solomon River Valley.

Later the main line of the Rock Island was built through the upland area to the north. Droughts discouraged many of the early settlers. Large scale mechanized farm operations replaced the family-sized farm and the population dwindled. With better rail facilities, farmers began sending their grain to markets in the eastern part of Kansas and the old water-powered mills were gradually abandoned. The county seat towns along the Rock Island replaced the river-bank towns as principal trade centers of the area.

In the pioneer era the Solomon Valley, with tree-lined stream banks, and rich alluvial soils, green with grass and growing crops, presented a striking contrast to the treeless expanse of prairie sod uplands. The thick buffalo grass on the uplands prevented erosion. Held by the grass the rains soaked into the soil and emerged in the valley as clear spring water. Crude dams were thrown across the channel of the spring-fed stream to provide water power for grist mills.

These early attempts to harness the Solomon River met with many difficulties. Floods frequently washed out the crude dams. During drought periods careful husbanding of the meager streamflow was necessary. As the water was released from the mill ponds of upstream mills, each miller in turn stored the flow until there was enough water to operate his mill for a short run.

One of these mills was built at Kirwin in 1872 by William H. Skinner. The mill stones or burrs for the grist mill were imported from France, and the first dam was constructed by laying trees in the channel with the limbs upstream, weighing them down with earth and rocks.

Floods frequently washed out the brush dam which gradually evolved to a rock-filled log crib and later to a concrete-faced log and masonry dam. The operators, Skinner and Adams, sold the mill to two of the Jackson brothers in 1882.

The Jacksons replaced the old millstones with roller-mill equipment, adding a gasoline engine in 1898 when there was not enough water in the stream to run the water wheel. From that time, the mill operated 24 hours a day during the busy season.

During the first world war the mills along the Solomon shipped flour to Europe, the Jacksons making a gift to the Belgians of a carload of flour from the Kirwin mill. So important was flour from the Solomon River Valley to the war effort that enemy agents burned several of the mills down to the ground.

The old Kirwin mill, which played such a big part in winning a world war and Kirwin's former

PIONEER WATER RESOURCE DEVELOPMENT on the Solomon River. *Map drawn from information furnished by Clyde M. Jackson, owner of the old Kirwin Mill (at right) now making way for Kirwin Dam. Photo by John N. Berg, Region 7 photographer.*

ESENT-DAY DEVELOPMENT UNDER WAY.—Above, H. E. Robinh, Konsos River District Manoger, opens the "dirt-moving emonies" at Kirwin Dom, Konsos, Morch 27, 1952. At right, yde Jockson holds on empty flour sack, left over from the time ien o lorge on-the-form population patronized his and the ier mills olong the River. Jackson and Homer Phillips, Kirwin m Field Engineer, ore working together to bring the "good old ys" bock to the Volley. *Photos by John N. Berg, Region 7.*

osperity, will make way for the structure which to win the war against flood and drought and ing prosperity again to the Solomon River alley. Clyde Jackson, former operator of the ill and the last of the Jackson family who opered water-powered mills at Cawker City, Downs d Kirwin on the North Fork of the Solomon d Osborne and Stockton on the South Fork of e Solomon, is tearing down the old mill, its nbers still sound after well over a half century service.

Kirwin is becoming an important crossroads wn again. Its business buildings are being reodeled and occupied. Empty residences are now led, and the busy sound of saw and hammer is ard as houses are being built for construction orkers yet to come. This is but a forerunner of e real prosperity that will come to this section the Solomon Valley when the irrigation system completed and Solomon River, the old Mill ream, goes to work again.

This time the river will not be turning the ater wheels of grist mills. Held back by Kirwin am, which will span the valley from rim to rim, e flood waters will be stored and used to irrigate ,500 acres of rich valley land. Periodic droughts d intermittent floods will no longer plague this autiful valley.

With an assured supply of water for crops, the lley farmers can engage in intensive agriculture, lanting for maximum production every year. Livestock operators over a wide area will be secure against feed shortages, such as occurred in the dismal 30's, when untold thousands of starving cattle were shot down in western Kansas feed lots.

The vision of progressive Solomon Valley residents such as John M. Gray of Kirwin, coupled with modern engineering knowledge, will create an economy of abundance resulting in better business, increased population, and greater economic stability in the area.

The dam, a rolled earthfill structure about 119 feet above streambed and with a crest length of more than two miles (11,300 feet, to be exact) will have a concrete spillway on the right abutment, and outlet works to provide for river and irrigation releases. The lake formed behind the dam will bear little resemblance to the old mill ponds. As has been the case in other areas, where large man-made lakes appear, fishing, hunting, swimming, boating, wildlife refuges and other conservation benefits and recreational opportunities never before known in northwest Kansas will accrue to the Solomon Valley where the people have learned the value of wise water resource development.

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HOW LAND IS SURVEYED

FROM THE AIR.—*Aerial photographs such as this, when rectified to appropriate scale, make excellent base maps for land classification*
Photograph courtesy of Pacific Aerial Surveys, Inc., Seattle, Wash.

by E. N. POULSON, Soil Scientist, and L. R. SWARNER, Irrigation Engineer, Boise, Idaho, Region 1

Part 7 in a series of articles on soils and land classification

To SERVE SATISFACTORILY ALL DEMANDS for evaluating land, three types of land classification of various intensity for specific purposes have been established; namely, reconnaissance, semidetailed, and detailed. The reconnaissance and semidetailed types are designed to provide preliminary information in project investigations. The detailed classification provides information for project authorization, development of the final plan for projects going into construction, or for the reappraisal of operating projects.

An objective of the land classification is to make field delineations on base maps of adequate scale and detail to serve the specific purpose for which they are intended. In reconnaissance and semidetailed work, the map scales are respectively 2,0[illegible] and 1,000 feet equals 1 inch. Topographic ma[illegible] on a scale of 400 feet equals 1 inch and having [illegible] 2-foot or less contour interval are used as the ba[illegible] maps in detailed surveys, as well as enlargemen[illegible] of aerial photographs. Early difficulties of ad[illegible]justing and assembling the material to a final ma[illegible] of accurate scale and satisfactory reproducti[illegible] have been largely overcome.

In detailed classification, examination of so[illegible] and land features are made at relatively close i[illegible]tervals of about 200 yards or less and land cla[illegible] separations are shown in as much detail as prac[illegible]cal. Thus, full detailed information as to th[illegible] character of the soil and land features on all pa[illegible]

N THE GROUND.—Special machines carve cylinders of undisturbed soil for alyses or to observe soil characteristics and permeability, especially in ation to drainage. *Photo courtesy of Oregon State College.*

the individual tracts or farm units is obtained. oil and subsoil conditions, topography and drainge are studied in detail for the purpose of land ppraisal, laying out the canal distribution system, itlining a drainage program and planning projt development.

A great many of the land class delineations are incident with easily discernible features, such change of slope, type of vegetation or promint soil characteristics. However, in order to operly evaluate surface soil and subsoil contions and to substantiate the judgment of the nd classifier, sufficient borings or pits are made representative areas. The borings and pits are nerally extended to at least 5 feet and occasionly to 10 feet or more. Careful observations are ade and samples are taken of the profile by ctions on the basis of changes in texture, strucre and profile development. Laboratory tests e performed on the samples. Various field tests e also made, such as for infiltration rate. The tensity of the examinations and sampling vary ith the intensity of survey and variability of il conditions. It ranges from a few samples ch square mile in a reconnaissance survey to at ast one for each 40-acre tract in detailed surys. More are taken where salt concentrations e common, where land drainability appears diffilt, or where soils have questionable water reining properties.

I THE LABORATORY, soils of proposed projects are subjected to emical analyses. Vernon G. Bushnell, soil scientist, at work his Region 1 laboratory. *Photo by Phil Merritt, Region 1.*

If there are questions about the textures of the soil, for example, in relation to moisture, laboratory analyses are made to determine the size particles that make up the soil. It may be necessary to make measurements of the moisture-holding capacity by use of special instruments that permit measurement of soil moisture under various tensions created by pressure or suction. In addition, many other physical measurements on water conductivity of soil and the stability of the soil under leaching may be necessary.

Determination of lime or total carbonates are

made by use of acid. The salinity or salt content and alkalinity or pH are determined mainly by routine electrolytic methods. Additional electrolytic and chemical procedures in the laboratory are used when necessary or desirable for sodium and other determinations.

The time necessary and costs involved in making field tests and laboratory analyses are trivial in comparison with the purposes they serve and project failures which may be avoided by the data obtained. Additional and perhaps more significant information is obtained through demonstrated experience in the general husbandry of similar soils, more refined field or plot experiments and other research. The Bureau of Reclamation depends largely on such information for evaluating the organic and mineral fertility deficiencies, as well as other deficiency factors that can be readily corrected by agronomic practices. The laboratory and field procedures are correlated with field responses and former experiences and utilized in extending practical knowledge of land capabilities to areas of undetermined suitability for continuous, profitable irrigation. The standards and procedures for land classification ha been developed on the basis of experience on rigation projects.

When all field and laboratory determinati have been made, final land class designations assigned to the individual delineated tracts a by appropriate symbols, the reasons for this cl sification are shown on the map. Most, if not of the soil testing data and profiles are also sho on the maps. Thus, the basic information is rectly available for use at all times.

The information supplied by land classificat maps and reports serves many purposes and data are as important to the success of a Reclan tion project as water supply data and engineeri design. The data are used for the determinat of project size and irrigable areas, water requi ments, irrigation and drainage systems, land velopment, land appraisal, payment capac project benefits and costs, establishment of ass ments, size of farm units, and proper land us

NEXT MONTH.—LAND CLASSIFICATION IRRIGATION STRUCTURES.

SUNNYSIDE PAYS OFF

A PICTURE MAY BE WORTH 1,000 WORDS. These pictures represent over two million dollars p back to the United States Government by successful reclamation farmers on the Sunnyside Divisior the Yakima project in the State of Washington.

THE "SUNNYSIDE OF LIFE" in the reclaimed West. Successful irrigation farming made possible a celebration on the Sunnyside Di of the Yakima project in the State of Washington on June 19, 1952, when Assistant Reclamation Commissioner Goodrich W. Linew (at left in photo at upper right) accepted two checks from H. E. Alexander, President of the Sunnyside Valley Irrigation Distric said, "Paid in Full." These checks marked the final and total repayment of about $2¼ million advanced for the constructi irrigation facilities in the Valley as part of the Federal investment in the reclamation of the West. The John Golob farm in the at upper left is typical of the security and success of the Valley. Farmer Reichert is the industrious worker carefully cultivating a fi sugar beets, one of the major irrigated crops developed as a result of Reclamation. *Both photos by Stan Rasmussen, Region 1 photogr*

Tall Wheat Grass

ALL WHEAT GRASS—Agrophyron elongatum, in a field north of lanti, Utah, on the Sanpete project. *Photo by W. H. Hirst.*

EDITOR'S NOTE: We are indebted to Paul K. Gardner, Editor-Publisher of the Lovelock Review-Miner, Lovelock, Nev., and Mr. F. A. (Gus) Momberg, Superintendent of the Nevada-Nile Corporation, Lovelock, Nev., for their cooperation in furnishing the material upon which this item is based.

TALL WHEAT GRASS may not be the the last word n pasture plants, but so far it has proved to be utstanding for permanent pasture, hay, and recamation of salty and alkali ground in Nevada.

Paul Gardner, editor-publisher of the Lovelock Review-Miner, Lovelock, Nev., says that tall wheat rass grows an inch a day in the Lovelock area, ut although the grass grows 7 or 8 feet tall, its reatest pasture value comes when it is short and ucculent. Gardner claims that tall wheat grass nay partially supplant alfalfa hay, as it permits arious methods of handling, and the fact that it an be used as pasture or combination of pasture nd harvesting makes it very attractive to ranchers.

However, he also points out that the longtemmed grass presents some difficulties, particuarly when planted in 3-foot rows for seed. Maured grass must be cut and left to dry, and when icked up by a combine, its length causes all inds of difficulties. So far, as little as 2 acres a ay can be threshed. Lightness of the seed also auses some trouble in catching it during the arvesting process.

Gus Momberg, Superintendent of the Nevada-Nile Corporation, Lovelock, Nev., believes that in a number of years a still better grass will be developed. A graduate of the University of California at Davis, he has the scientific attitude, plus a vast amount of experience, and when it comes to tall wheat grass he has tested it on levelled, irrigated, salt free, salty and alkali soils in the Lovelock Valley. He reached the accompanying conclusions only after 3 years of testing plus analyzing information contained in 40 letters received from United States Agricultural Experiment stations in different parts of the country, including reports on special tests by Colorado A. and M.

TALL WHEAT GRASS AS A PASTURE PLANT

1. Very vigorous grower and heavy producer. The better the land the higher the yields.
2. Palatability fair to good, depending on growing conditions and management.
3. Under irrigation on moderately salty, to soils up to 1.50 percent salt, will out-yield any known grass for the area.
4. Provides earlier and later pasture than other grasses if rested in late summer and fertilized, reducing corral feeding.
5. Will provide an income while reclaiming salty land if drainage is provided.
6. In quality is comparable to other grasses cut at same stage of maturity.
7. Dense plantings provide more leafy forage than sparse stands.
8. Produces seed easily and volunteers and reseeds itself readily.
9. Should be tried under varied conditions of grass and hay production along the Humboldt River bottoms, and compared with present forage as well as other deep-rooted grasses, such as Pubescent, Intermediate Wheat Grass, Smooth Brome, etc.
10. With the inroads of Halogeton, and reduction of range carrying capacity, by law and nature, the only "out" for the cattle producer in northern Nevada, besides range improvement, is to eliminate the wiregrass, willows and sagebrush in the river bottoms and replace them with good forage, provided there is a maximum of water control instead of the present free flooding.

Livestock producers and farmers in the intermountain area first heard of this tall wheat grass in 1948. A bunch grass, selected from importations of various wheat grass seeds from south-

R. J. Walter, Jr., Receives Gold Medal and Distinguished Service Award

R. J. (Rudy) Walter, Jr., construction engineer for the Bureau of Reclamation at Grand Island, Nebr., was presented with a gold medal and the certificate for Distinguished Service Award by Commissioner Michael W. Straus at the Bonny Dam dedication on May 31. The medal and award, the highest employee commendation given by the Department of the Interior, were presented in recognition of his flood warning (see October 1951 issue of the Reclamation Era, p. 215) to the residents of Hays and Ellis, Kans., in June 1951 when his efforts resulted in keeping property damage to a minimum and preventing any loss of life.

AWARD FOR WALTER—R. J. (Rudy) Wolter being presented with Distinguished Service Award by Reclomotion Commissioner Michael W. Straus during Bonny Dam dedicotion. Left to right, Betty Wisdom, Shirley Jean Isham, Eloine Raile, Straus, Walter and Shirley Shaffer. *Photo by John N. Berg, Region 7 photographer.*

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western Siberia, it is long-lived, withstands cold and drought, and its chief merit lies in its ability to become established and yield well in saline or alkali soil. If planted between November and May at elevations of 4,000 to 5,000 feet, it will make a stand in salty land while the weather is cool to frosty. If planted in late spring or early summer, it will, of course, have trouble overcoming excess salt when the temperature and surface soil evaporation is high.

In forage production under moisture conditions of 15 inches or more, it has outyielded other known grasses on good soils. In liveweight grain tests at the Colorado A. and M. experiment station in 1949 and 1950, tall wheat grass outyielded other grasses from 10 to 50 percent. This trial was on good soil with 15 inches of rainfall. Average liveweight gains per acre for the two-year period were 154 pounds. Similar results were also obtained at the Wyoming experiment station.

In 1951, the Nevada-Nile Corp. at Lovelock pastured 1.3 acres of tall wheat grass which had been planted the previous year. This parcel was cut for hay on June 1, July 15 and August 25, besides being pastured during this period. The hay production was close to 3 tons per acre. On September 10, four steers averaging 727 pounds per head were put on the acreage and pastured until October 31. They gained an average of 1.8 pounds per head each day, totaling 92 pounds after shrinkage. During the entire season, from June to October, livestock gained 368 pounds or 28[illegible] pounds per acre on the 1.3 acre pasture. Weaners were pastured from October 31 to December 1[illegible] when the field was still green but growth of the grass had stopped. Tall wheat grass could have been pastured from May 1 to December 1 with 2 or 3 head per acre and still leave some hay for cutting. A conservative estimate of liveweight gain for the season would be over 500 pounds per acre. Part of this 1.3 acre pasture was in salt grass in 1949, when it was planted to tall wheat grass, which has become established in the salt grass and will gradually take over that area.

Horses readily consume the hay, and after seed threshing, wheat grass straw is as good or better than overmature meadow hay for wintering cattle. The protein of hay cut at Lovelock in June 1951 was 11.7 percent.

The Nevada-Nile Corp., where there is a considerable acreage of saline soils now provided with drain ditches, is planting over 1,500 acres of the grass, which will provide plenty of good forage during the next few years while the land is being leached. After leaching, the land will be well provided with organic matter as the roots of this grass go down more than 8 feet. ###

Golden Jubilee Baby Arrives

Reclamation's Golden Jubilee Baby, a girl, was rn on June 5 to the Donald D. Dunn's at Yakia, Wash. Dunn was the veteran selected by e Veterans of Foreign Wars to receive the Farm-a-Day on the Columbia Basin project (see Den for Modern Farm Living on page 103 of the ay 1952 issue of the Reclamation Era).

The Dunn baby is the recipient of a multitude gifts donated in the course of the Farm-in-a-ay program including a gold plated No. 2 irritor's shovel presented by the National Reclamaon Association, complete layette, toys, a baby eer, and a Moslem prayer rug. Additional deils on the Dunns and Baby Dunn will appear in rthcoming issues of the Era. •

Sacramento Canals OK'D

Secretary of the Interior Oscar L. Chapman, rly in May, approved the Bureau of Reclamaon's finding of feasibility on the Sacramento Canals unit of the Central Valley project of California, and forwarded it to State and Federal officials for comment and review. The canals were authorized by Public Law 839, Eighty-first Congress, which required submittal of Secretary's finding of feasibility to the Congress prior to initiation of construction of the canals. (See Canals for Sacramento Valley on p. 138, RECLAMATION ERA, July 1951.)

This addition to the Central Valley project would provide irrigation water for 205,000 acres along the Sacramento River in Tehama, Colusa, and Butte Counties. Water for the Sacramento Canals unit would be made available by diversion of Trinity River surplus water. The plan involves distributing approximately 660,000 acre-feet of water a year through three main canals from the Sacramento River. They are the Corning Canal, the Tehama-Colusa Canal, and the Chico Canal.

In addition to the main canals, distribution and drainage systems will be needed to deliver water from the canals to the farm headgates and to carry off unused water. •

Yuma Mesa Farms Go to 27 Lucky Vets

At Yuma, Ariz., on June 3, during a drawing y members of local veterans organizations, 27 ar veterans won first consideration to be warded a family sized farm on the Yuma Mesa ter this year. The drawing was held publicly the Mary Elizabeth Post School and was dicted by a committee representative of homeeaders who settled on the Yuma Mesa in 1948.

All told, a total of 4,111 vets of World Wars I nd II, the Spanish-American War, and the Philppine Insurrection applied for the farms which omprise an area of 4,030 acres and range in size om 113 to 160 acres.

The applicant priority list contains a total of 2 names. If for any reason the settlement ard, consisting of Stephen R. Blake, chairman; Villiam A. Steenbergen, secretary and representive of the Bureau of Reclamation; Gerald idier, and R. H. McElhaney, disqualifies one or ore of the 27 top priority applicants, others on e 162 name list will be considered for farms in e order their names were drawn.

Ian A. Briggs, land use and settlement chief of e Bureau's Region 3, served as master of ceremonies, and operation and maintenance supervisor of the region, A. B. West, read a message from Acting Commissioner G. W. Lineweaver wishing the prospective settlers success in their new homesteads. •

LONG ODDS faced the 4,111 veterans who tried for one of the 27 homestead farms on the Yuma-Mesa Division of the Gila project in Arizona. The Operations Division Staff of the Bureau at Yuma, Ariz., is busy capsuling the names of the entrants prior to the drawing June 3. Left to right: George Gamard, Fern Wilses, Evlyn McGill, William A. Steenbergen, Ralph Habden, Rita Gonzales, Robert Coutchie, Maurice N. Langley.

WELCOME, STRANGER!

"ALL NATION'S DAY" AT EPHRATA, WASH. Flags of 25 nations, and the International Flag of Good Will on the right, were displayed to promote world peace and better understanding among the nations of the world. Delegates to the International Reclamation Conference represented a billion people from foreign lands. Left to right are: Lt. Walker, General's Aide; Dr. D. A. FitzGerald of the Mutual Security Agency; Sirmen Kurtcebe of Turkey in the background; Gen. H. R. Bowman, Commanding Officer of the Larson Air Base; Amin Hamza of Iraq in the background; Senor Salvadore Aquilar Chavez of Mexico; Columbia Basin Festival Princess June Edgar of Pasco; M. N. Bhattarai of Nepal; M. N Samii of Iran; Donald Dunn, the Nation's most worthy veteran who was given the Farm-In-A-Day on the Columbia Basin project United States Reclamation Commissioner Michael W. Straus; Na tional Reclamation Association President, C. Petrus Peterson United States Representative Walt Horan of Wenatchee, Wash. Columbia River District Manager H. A. Parker; United State Representative Hal Holmes of Ellensburg, Wash., and Frank Banks builder of Grand Coulee Dam.

Water users of the West played host to visiting reclamation dignitaries from Pakistan, Formosa, Australia, Mexico, India, Iran, Canada, Iraq, Japan, Ethiopia, Brazil, Panama, Vietnam, Cambodia, Thailand, Turkey, Venezuela, Colombia, Nepal, El Salvador, Philippines, Burma, the Dominican Republić, and Lebanon during the International Reclamation Conference from May 27 through June 22, and it would be difficult to state whether the domestic or foreign participants gained the most from the experience.

IN NO OTHER PLACE IN THE WORLD can farmers work under better conditions said the foreign conferees as (1) they saw how crops were grown, (2) marveled at modern distribution methods and nearby markets, and (3) were amazed at mechanical food processing.

The visitors got first-hand information on how people live, worked and played in the reclamation area, and the residents and United States participants in the conference got first-hand information about the far-flung corners of the globe, learning many things which do not appear in the geography books or current journals. Things that they had taken for granted all their lives attained greater value and dimension as contrasts were revealed with conditions elsewhere. All those who came in contact with the conference members gained valuable information and a fresh appreciation of the American way of life.

In the course of the tour, the conferees attended a demonstration of "democracy at work" at

eeting of the Terrace Heights Grange, Yakima, ash., and saw first-hand how the people play eir part in forging local, State and national licy.

They watched irrigated crops as they were har- sted, processed, and shipped off to market, saw rm machinery in the making, were invited into ivate homes, visited schools and churches, were nored at a Boy Scout circus and last, but not st, learned to square dance in the best Western adition.

Almost like a homecoming was the visit of lian A. Buendia, Irrigation Chief for the Phil- pines who worked as a trainee on the Yakima oject in Washington when the main canal of the ttitas Division was being built in 1927 and 1928. e was amazed at the development he saw. The e and the speed with which the project had veloped impressed him, but more than that he uld hardly believe the greenness of the once rren lands and the cities where small communi- s existed during his former visit.

As one of the major problems the delegates face their own reclamation programs is the instruc- n of potential users of the projects, the foreign perts were particularly interested in the county tension agent system that puts an expert within lephone reach of the farmer, and the land grant llege system that ties in teaching, research and -the-area farmer education. Myo Han of Burma id, "In no other place in the world can the farmer rk under better conditions." He was particu- rly struck by the close work of the extension rvice with the project farmers and claimed a nilar system would work wonders for the farm- s in his country.

The distinguished representatives from foreign lands were extremely interested in our modern financial institutions. They visited a Yakima bank where services to the borrower and depositor were explained, as well as the system of credit ratings, interest on various types of loans, employee incentives and many other things unheard of in their countries. The low interest rates on loans astounded them, many of them pointing out that in their countries the rates were as high as 50 percent.

Huynh Van Diem, Chief Engineer of Vietnam's Department of Public Works, said he had expected that the large numbers of agencies involved in the Columbia Basin project would make it much more difficult to complete and operate. However, after the conferees attended a meeting of the Columbia Basin Inter-Agency Committee at Othello, they saw how the cooperative arrangements worked, and came away with ideas for similar organizations in their own countries which would insure local control of the giant projects now under way.

The typical comment of the visitors about Yakima, the Columbia Basin, Grand Coulee Dam and the United States in general was, "So big!"

O BIG!"—but the biggest thing was the hospitality, said the visitors as they saw how we keep weed seeds out of Yakima's Roza canal, (5) how "do the impossible" at Grand Coulee Dam, (6) learned during study periods v democracy works, (7) had a taste of 4–H Club work, and (8) square danced h "the wonderful people" of the Terrace Heights Grange.

But one of the biggest thing about the United States, according to Rochanasiri Warindr, Administrative Chief of the Royal Irrigation Department, Bangkok, Thailand, was its hospitality. "I feel highly impressed by the friendliness of the people. Everywhere I go, it is 'welcome, welcome, welcome.' I won't forget to tell my people about this when I return home."

Chances are his people and many people throughout the world were learning about this at the time. The Voice of America was sending broadcasts every hour on the hour during the Columbia Basin festival to countries all over the world. Some of the Columbia Basin settlers got into the act, which featured interviews with basin folks. Little Yvonne Tschirkey of the Pasco Unit stood entranced as she listened to her father, Robert Tschirkey, speak a Swiss dialect as the State Department broadcast relayed the story of the celebration around the globe.

The tour started in Spokane, Wash., with a Chamber of Commerce luncheon attended by 300 businessmen, where the foreign reclamation observers began to learn the true meaning of the Western greeting, "Welcome, stranger!"

Later, a hospitality committee made up of the leading citizens of Spokane honored the group at a dinner where Elwood Ball, chairman of the committee, keynoted the theme of the Conference when he said, "Through an exchange of ideas, more neighborliness, and a better mutual understanding, we are taking an important step toward world peace."

The conference coincided with the Columbia Basin project's celebration of the first water to be turned on to the irrigation farmlands from behind Grand Coulee Dam, and the June 17 Golden Jubilee celebration at the Colorado-Big Thompson project, embraced a seminar at Yakima, Wash., and concluded with study tours and seminars at the Reclamation Engineering Center, in Denver, Colo.

All Nation's Day was held on May 29 at Ephrata, where a "Little World's Fair" was set up in an airport area, and a color guard from Larson Air Base carried the flags of 25 nations and the International Flag of Good Will during the Flag ceremonies. On that day Mutual Security Agency's Assistant Administrator D. A. FitzGerald termed Grand Coulee Dam one of the outstanding accomplishments of man and reminded his listeners that people in many parts of the globe contributed to its achievement. He stated that before the turn of the century, representatives of the United States were sent to other countries to study their methods of irrigation, land reclamation and water resource development and have continued these studies through the years. In a spirit of gratitude and cooperation, he said, the United States has embarked upon the present Point Four program, of which the International Reclamation Conference is a part.

The 27 foreign visitors, each an influential reclamation official in his own country, represented about a billion people over the globe. The monthlong series of technical conferences and study tours was spearheaded by the Office of Foreign Activities of the Bureau of Reclamation with financial and moral support by the Mutual Security Agency and the Technical Cooperation Administration. Expenses of the observers were paid out of foreign aid funds, although no amount of money could have bought the cordial reception given to the visitors by the people of the West, the United States Senators and Representatives, high ranking cabinet officials, State officials and prominent reclamation authorities from all over the United States who participated during the tour.

Jose Guinaraes Duque, Irrigation Department Chief of Agricultural Industries Services from Brazil evaluated the conference at its conclusion by saying, "Here in the Western United States we have seen the amazing job you have done to develop your natural resources, and I am certain that we, too, can learn much and, I hope, accomplish a great deal more because you have shown us that nothing is impossible." ###

Palmer and Wallace Honored

William R. Palmer of Cedar City, Utah, and William R. Wallace of Salt Lake City, Utah, received honorary doctorates from the Utah State Agricultural College on June 9. Mr. Palmer is a well-known historian and an authority on Indian lore and culture in the State of Utah. He has been active in irrigation district affiairs and has been an occasional contributor to the Reclamation Era (see Utah's "Water Courts," November 1947 issue, page 233). Mr. Wallace has long been an irrigation leader in Utah and throughout the West. He was also a member of the Utah Water Storage Commission for over 2 decades and is a representative of the Board of Directors of the National Reclamation Association. •

LETTERS

Spirit of Good Will

ttorney General Edmund G. Brown California recently wrote us as fol- s regarding his article entitled re Water for More People" which eared in the March 1952 issue:

I hope that I can be of some con- ictive force in my State and Na- . Some of these problems are not , but I am sure that if everyone roaches them in the spirit of good much can be accomplished."

Texas Testimonial

a recent letter to Commissioner hael W. Straus, Judge Oscar C. cy of Brownsville, Cameron Coun- Tex., had this to say about the . "I have just received the June of the RECLAMATION ERA. I n't had time to read very much of ut it is just wonderful, and I shall l' a great deal of 'thunder' for my t speech over the radio, from said e."

hank you, Judge Dancy, and I hope you will continue to find the ERA ful in your forthcoming talks. Ed.

RELEASES

v Canyon Ferry Folder Available

new illustrated folder on the Can- Ferry Unit of the Missouri River in project is now available to the ral public. In addition to a num- of halftones and two linecuts the er contains statistical data relative e Unit. Copies may be had with- cost by writing to the Regional ctor, Bureau of Reclamation. ings, Mont.

us' Lectures Translated Into Arabic and Spanish

recent monograph "Natural Re- ces Development" by Commissioner Reclamation Michael W. Straus has eved university text status in three uages.

he monograph is a series of 16 lec- s by Commissioner Straus before Latin-American Training Center in tiago, Chile, last year under the aus- s of the United Nations Food and Agriculture Organization. It has since been compiled in booklet form and, in addition to English and Spanish editions, has now been translated in Arabic for use in Iraq, Iran, Lebanon, Syria, and Egypt.

The request from the University of Wisconsin was for a supply of the booklet for classroom use in a course on government and natural resources. Other colleges and universities plan similar utilization which particularly deal with administration and execution of resource development programs based on the American Reclamation program. Copies of the monograph are available free of charge upon request of our office.

Free Heating Information

The Kilbury Manufacturing Co., has available to readers of the RECLAMATION ERA, free of charge, catalogs on forced-air electric heaters for homes, office, and factory. The address is 14529 Hawthorne Blvd., Lawndale, Calif.

New Maps Available

The drafting section of the Bureau of Reclamation has just completed five new project maps. They are of the Buffalo Rapids, Huntley, Intake, and Milk River projects, all in Montana, and the lower Yellowstone project in Montana and North Dakota.

All maps are in color and are available in the small size only (10½ by 17 inches). Requests should be sent to your nearest regional director (see list on inside back cover of this issue) specifying the name of the map or maps desired. Single copies are available free to those who need them in connection with their work or studies.

Canal Lining Booklet Available

The Bureau of Reclamation has been conducting a lower cost canal lining research program during the last 6 years and the findings to date have been published in a 70-page booklet entitled "Canal Linings and Methods of Reducing Costs."

The booklet points out that at the 25 percent seepage rate on unlined canals and laterals in 1949, the 3,900,000 acre-feet of water lost on 46 Federal projects would have been more than adequate to irrigate an additional million acres of land. Lower cost linings have already resulted in more than $5 million in water savings and increased values in irrigated western farms on Reclamation projects.

The characteristics of the various linings, costs, and application are discussed in detail in the publication which may be obtained for 25 cents per copy. Write to the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C., or Chief, Supply Field Division, Bureau of Reclamation, Denver Federal Center, Denver, Colorado.

Reclamation Reservoirs Pay Extra Dividend

A new illustrated booklet describing how the Bureau of Reclamation is contributing to fish and wildlife conservation and providing recreation for more than 6,500,000 people in a year's time, with economic benefits amounting to $37,000,000 annually, has just been issued. It includes a directory of fish and wildlife and recreational facilities at 103 of the Bureau's reservoirs, located on 49 Reclamation projects. A limited number of copies are available to the public upon request to the Commissioner's Office in Washington, D. C., or to any one of the Bureau's seven Regional Offices.

The report, containing 63 pages, was prepared at the request of Representative John R. Murdock, of Arizona, Chairman of the House Committee on Interior and Insular Affairs, who has introduced a Resolution to have the report printed as a House Document.

WANTED!

Missing copies and volumes of the Reclamation Era's predecessors—the Reclamation Service's and Bureau of Reclamation's official publications.

PROGRAM FOR SUPERVISING AND CONSULTING ENGINEERS AND EXPERTS (the first official publication of the Reclamation Service)

Vol. 1, No. 1, March 1905.
Vol. 1, No. 5, April 21, 1907.
Vol. 1, No. 115. June 3, 1907.

MONTHLY BULLETIN

Vol. I, 1908 and 1909 (entire set).

RECLAMATION RECORD

Vol. 3, 1912 (entire set).
Vol. 4, 1913 (entire set).

If you have any of the above, please send them to THE RECLAMATION ERA, Code 460, United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

Needed—30 Million Kilowatts in Three Years

During the fifth conference of the Electric Utility Advisory Council, held on December 6, 1951, attended by representatives of all phases of the private and public electric utility industry, the 31 members present stated that they were planning to increase the generating capability of the Nation by approximately 30 million kilowatts in 1952, 1953, and 1954. According to James F. Fairman of the Defense Electric Power Administration, this proposed electric power expansion would improve the power supply situation on the basis of present load estimates, but any new loads of large size now developing and not included in these estimates could completely wipe out this gain. During 1951, he said, generating capacity went up 7 million kilowatts, but power requirements went up 7½ million kilowatts, and the results of using up the margin between supply and demand were reflected in unfavorable conditions in several parts of the country. He cited in particular the Pacific Northwest where it became necessary to interrupt 100,000 kilowatts of aluminum production for nearly three weeks. Genuine improvement in that area, he said, depends upon the completion of projects which are not due to come into service until 1954 and 1955. •

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NOTES FOR CONTRACTORS

Contracts Awarded During June 1952

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contr amoun
DC-3555	Missouri River Basin, Wyo.-Mont.	June 27	Construction of 46 miles of Lovell-Yellowtail 115-kv transmission line.	C-L Electric Co., Pocatello, Idaho.	$445,
DS-3653	Eklutna, Alaska	June 10	Five 34,500-volt circuit breakers for Anchorage substation, schedule 2.	Westinghouse Electric Corp., Denver, Colo.	54,
DS-3677	Missouri River Basin, S. Dak.	June 18	Eight deicing air-switch assemblies for Fort Randall switchyard, schedule 2.	Schwager-Wood Corp., Portland, Oreg.	30,
DC-3696	Central Valley, Calif.	June 6	Furnishing and installing two 7,500-kilovolt-ampere vertical-shaft generators for Nimbus power plant.	Elliott Company, Jeanette, Pa.	464,
DS-3702	do	June 9	One 1,000-kilovolt-ampere station-service unit substation for Folsom power plant.	I-T-E Circuit Breaker Co., Philadelphia, Pa.	32,
DS-3707	Kendrick, Wyo.	June 10	Two indoor switchgear assemblies for Alcova power plant	Westinghouse Electric Corp., Denver, Colo.	34,
DC-3710	Columbia Basin, Wash.	June 6	Construction of earthwork, asphaltic membrane lining, and structures for area W-6A laterals, sublaterals, and wasteways, West canal laterals.	Cherf Bros. Construction Co. and Sandkay Contractors, Inc., Ephrata, Wash.	1,031,
DC-3711	Central Valley, Calif.	June 11	Construction of earthwork, concrete pipeline, and structures for lateral 25.6 on the Contra Costa canal distribution system, Contra Costa County water district.	Stolte, Inc., Oakland, Calif.	167,
DC-3713	do	June 18	Construction of Nimbus dam, power plant, and appurtenant works.	Winston Bros. Co. and Al Johnson Construction Co., Monrovia, Calif.	6,067
DC-3715	Columbia Basin, Wash.	June 30	Installation of two 1,350-cubic feet per second vertical-shaft, centrifugal-type pumps for units P5 and P6 in Grand Coulee pumping plant; and miscellaneous metalwork and electrical installations in Grand Coulee Dam, power plant, and pumping plant.	Eichleay Corp., Mt. View, Calif.	52
DC-3717	Parker Dam Power, Ariz.-Calif.	June 19	Modification of turbine draft-tube stop logs for Parker power plant.	Western Iron and Metal Co., Los Angeles, Calif.	2[illegible]
DS-3718	Central Valley Calif.	June 23	One lot of embedded metalwork for 40- by 24-foot radial gates at Nimbus Dam.	Valley Iron Works, Yakima, Wash.	9[illegible]
DC-3720	Missouri River Basin, Kansas-Nebr.	June 25	Construction of earthwork and structures for Franklin Canal and drains, schedules 2, 3, and 4.	Bushman Construction Co., St. Joseph, Mo.	1,20[illegible]
DC-3723	Davis Dam, Ariz.-Nev.	June 25	Completion of gravel fill and metalwork for Davis Dam and power plant, schedule 2.	George E. Miller, Long Beach, Calif.	5[illegible]
DC-3723	Davis Dam, Ariz.-Nev.	June 27	Concrete, architectural finishes, and plumbing for Davis Dam and power plant, schedule 1.	Jack Wilson, Downey, Calif.	[illegible]
DC-3732	Fort Peck, Mont.	June 30	Construction of Dawson County substation and connecting transmission lines; an office building and warehouse adjacent to Dawson County substation; power distribution line; and additions to Williston substation.	Northolt Electric Co., Grand Forks, N. Dak.	17[illegible]
DC-3733	Eden, Wyo.	June 27	Construction of earthwork and structures for Means and Eden Canals, and channel changes and wasteway.	Young and Smith Construction Co., Salt Lake City, Utah.	51[illegible]
100C-143	Palisades, Idaho	June 12	Construction of administration building for community facilities.	J. H. Wise & Son, Inc., Boise, Idaho.	16[illegible]
200C-198	Klamath, Oreg.-Calif.	June 16	Earthwork and rehabilitation, southwest (No. 2) sump dikes	George R. Stacey, Tulelake, Calif.	64
200C-199	Central Valley, Calif.	June 24	Erosion control for Tracy Pumping Plant	Justice-Dun Co., Oakland, Calif.	2[illegible]
200C-200	Central Valley, Calif.	June 24	Drilling holes and constructing drains for slope stabilization on Contra Costa, and Ygnacio Canals.	J. N. Pitcher Co., Daly City, Calif.	10
300C-35	Parker-Davis, Ariz.-Calif.-Nev.	June 13	Construction of residences at Parker Dam Government camp	Pritchett Construction Co., Farson, Wyo.	11
400C-29	Grand Valley, Colo.	June 16	Badger Wash chute	Cecil B. Shaffer, Fruita, Colo.	1[illegible]
601C-22	Shoshone, Wyo.	June 10	Six miles of closed drains on Heart Mountain Division	Long Construction Co., Billings, Mont.	5[illegible]

Construction and Materials for Which Bids Will Be Requested by October 1952

Project	Description of work or material
uma, Calif.	Construction of 500- by 280-foot concrete-lined Ortega Reservoir located north of Summerland, Calif.; 340-foot square concrete-lined Carpinteria Reservoir located northeast of Carpinteria; 18- by 49-foot reinforced concrete control station buildings; and installation of chlorination equipment, 30- and 24-inch steel pipe and 1,400 feet of 30-, 24- and 18-inch concrete pipe.
al Valley, Calif.	Construction of two 5,000-cubic feet per second capacity radial gate concrete check structures on the Friant-Kern Canal near Orange Cove, Calif. Both structures include 100-foot long inlet and outlet transitions and require about 900 cubic yards of concrete.
o.	Extension of Ivanhoe irrigation district laterals on the Friant-Kern Canal distribution system near Ivanhoo, Calif., involves excavating and backfilling 4.8 miles of pipe trenches, furnishing and laying 3.8 miles of 12- and 15-inch concrete irrigation pipe; and laying 1 mile of 12-inch Government-furnished concrete irrigation pipe.
bia Basin, Wash.	Construction of 0.5 mile of 2 to 5 cubic feet per second capacity distribution system for part-time farm units in Block 41, lateral area E-2 on East Low Canal near Moses Lake, Wash.
Dam, Ariz.	Erecting additional steel structures for Prescott substation near Prescott, Ariz.
r.	Installation of unit substation, electrical equipment, steel structures, and construction of concrete foundations at Maricopa substation near Maricopa, Ariz.
na, Alaska	Two 25-kilovolt-amperes, 7,200 to 120/240-volt, single-phase transformers and two 17-kilowatt, 113-volt, resistor units for Eklutna power plant.
ick, Wyo.	Realining 1,700 feet of laterals 256-55R and 256-74L, 600 feet of which is to be earth-lined; constructing 700 feet of lateral and wasteway, riprap drainage inlet structure, one concrete drop, two weirs, two turnouts, and two checks about 10 miles west of Casper, Wyo.
	Dismantling 25 miles of 34.5-kilovolt Seminoe-Sinclair transmission line, extending from 3 miles south of Seminoe Dam to 2 miles northwest of Sinclair, Wyo. Materials are to be salvaged and returned to the Government at Sinclair.

Project	Description of work or material
Middle Rio Grande, N. Mex.	Construction of channel headquarter buildings at San Marcial, N. Mex. Included are a three-bedroom 34- by 42-foot concrete block dwelling, a 40- by 100-foot office warehouse, a 12- by 24-foot concrete block storage building, and an 8- by 10-foot concrete block pump house.
Do.	Excavation and improvement of 17 miles of Rio Grande drainage and conveyance channel and levee from San Marcial, N. Mex., to channel headworks.
Missouri River Basin, Kansas-Nebr.	Preparation of a district headquarters office building at McCook, Nebr. which involves remodeling a 14,000 square foot brick building into an office building and constructing a 2,000 square foot, 1-story addition with a basement of the same floor area. The contractor will be required to furnish most of the materials; construct footings, foundations and concrete floors for several other buildings to be erected under other contracts; grade entire area, and install water and sewer lines to all buildings.
Missouri River Basin, Wyo.	Excavate, load, haul and truck-spread 5,000 cubic yards of shale for surfacing a county road in the vicinity of Keyhole Dam near Moorcroft, Wyo.
Do.	One 115-kilovolt circuit breaker, one 115-kilovolt selector switch, and one 115-kilovolt disconnecting switch for Alcova switchyard.
Do.	Painting certain exposed metalwork, piping, and conduits in Boysen power plant and switchyard.
Palisades, Idaho	Four oil pressure, cabinet-type actuator governors for regulating the speed of four 39,500-horsepower hydraulic turbines for Palisades power plant.
Provo River, Utah	Placing riprap on unprotected sections of river banks along 10-mile reach or Provo River channel about 13 miles northeast of Provo, Utah.
Tucumcari, N. Mex.	Construction of 4 miles of surface drains and structures near Tucumcari, N. Mex.

United States Department of the Interior, Oscar L. Chapman, Secretary

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Official Publication of the Bureau of Reclamation

September 1952

Volume 38, No. 9

The Reclamation ERA

35 Years Ago In The Era

War Time Crop Rotations

There seems to be an inclination among farmers to forget that there's such a thing as crop rotation and to produce the crops that at this time are bringing in the most money. The production of the staple crops most needed now is the right thing to do as long as the farmer does not "kill the goose that lays the golden egg." Soils have their limitations and the farmer must keep in mind the fact that he will have to keep right on producing food after the war is over. He should not throw his crop rotation plans so much out of gear that he will be unable to produce profitable crops under normal conditions in normal times.

(From p. 426, September 1917 issue of the RECLAMATION RECORD, predecessor to the RECLAMATION ERA.)

OUR FRONT COVER—CASH CROP—Donald D. Dunn, winner of the Farm-in-a-Day (see p. 214) and his dog inspect the bean field which will be harvested this month on his Columbia Basin project farm in the State of Washington. Photo by Fran B. Pomeroy, Region 1 photographer.

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DESIGN AND ILLUSTRATIONS by Graphics Section, Bureau of Reclamation, Washington, D. C.

R. F. Sadler, Editor.

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IN THIS ISSUE

Reclamation Place Names In This Issue

NEW LIFE FOR THE SOIL

y
RUCE F. BEACHER, Soil Scientist
ureau of Reclamation, Washington, D. C.

POUND=200 POUNDS.—Dr. R. M. Hedrick ith a pound of Krilium, which does the same ob of soil conditioning as the pile of peat moss sed on 100 square feet of garden. *All photos or this article, courtesy of the Monsanto Chemi- al Co., New York, N. Y.*

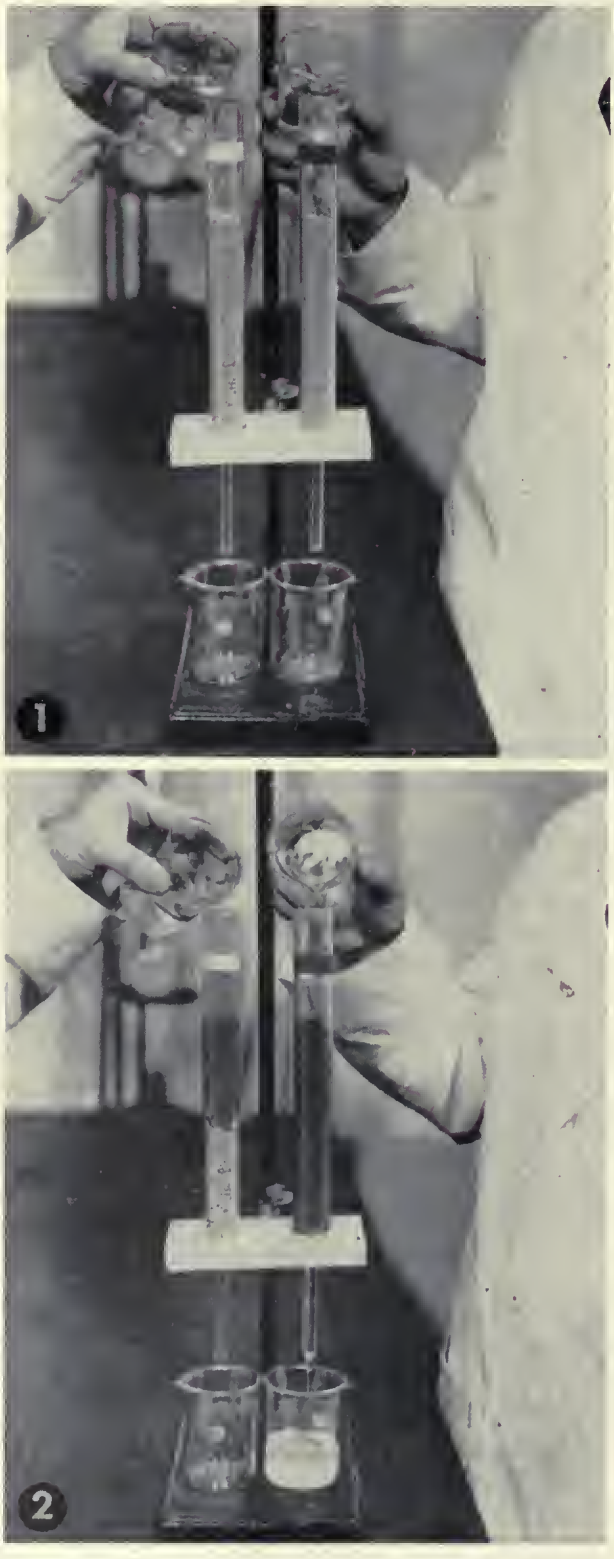
Krilium, Aerotil, Fluffium, Acrylon, and ther new soil conditioners may eventually be the nswer to the irrigation farmer's prayer for a eapon against his old enemy—gumbo. Experi- ents up to the present time have indicated that hese synthetic resins, which can be dissolved in ater, help to germinate seeds, enable a farmer to low earlier in spring, keep soil from clodding, ontrol erosion, save water by holding more of it in he soil for a longer time, increase crop yields, help olve the drainage problem and can even be used to ondition footpaths, playgrounds, tennis courts, aseball diamonds, and the like to give a quick- rying surface and cut down on dust and mud. nother possible use of great importance to irri- ators is in the reclamation of alkali lands. At resent, the Bureau of Reclamation is cooperating ith the Colorado Agricultural Experiment Sta- ion in making studies with synthetic soil condi- ioners on alkali soils of the San Luis Valley roject, and plans additional work elsewhere. Iuch experimentation is being conducted by the tate Agricultural Experiment Stations in order to determine how to apply these materials for best results and what effects can be expected on all types of soils and crops.

First, we must caution that the soil conditioners are not fertilizers. Soil scientists and agrono- mists, who have been concentrating on problems of soil structure as well as those of soil fertility dur- ing the past 20 years or more, have observed that the framework of the soil is just as important, and in some cases more so, than the supply and avail- ability of plant nutrients. An irrigator, who has desperately tried to improve a soil that puddles when it is wet and crusts as hard as a turtle's back when it dries, certainly recognizes the truth of this observation.

This problem of soil structure, and packing of soil particles so closely together that the soil repels water, air and roots, is quite widespread and has resulted in submarginal farming and even the abandonment of many thousands of acres of land under ditches.

About 10 years ago, chemists in the research laboratories of one of the Nation's leading chem-

CONDITIONED SOIL LETS ALL THE WATER THROUGH.—Soil in the tube at left has not been treated; at right, treated soil. Using the same amount of water and soil, photo No. 2 shows how the untreated soil obstructs the passage of water.



ical companies started to work on the probl of finding a quick cure for physically sick soi They knew that many tons of manure, compo and other organic materials are required to p duce a relatively few pounds of the natural gu which create good structure in soils. They al knew that, unfortunately, these natural sticky m terials or "polyuronides" are temporary in the s and vulnerable to decay by bacteria.

After trying over 700 samples of chemi synthetics as possible substitutes for natural s conditioners, they narrowed the search down the hydrolyzed polyacrylonitriles, which a manufactured from acetylene and hydrocyan acid, and to a vinyl acetate-maleic acid compour The large molecules of the substances ha hundreds of points at which they can combi with inorganic chemical elements in the clay the soil.

Applied as powders or as a water solution, t compounds seem to coat the soil particles a create a spongelike structure in the soil, holdi the particles together, despite running or percol ing water and disturbance. At the same time, th keep the "pores" open, thus improving aeratic drainage and making it easier for the farmer plow or cultivate. They help to maintain go structure in soils which puddle when irrigat and bake or crack on drying after irrigation. Y more water can be taken up and held by treat soil than can be absorbed by untreated soil.

At Dayton, Ohio, experiments proved that cases of very poor soil structure, the yields vegetables and root crops could be double tripled and in some cases increased 10 to 20 tim through the use of the products. The best resu were obtained with the least amount of con tioners where sodium, calcium, and magnesiu were present in the soils. These elements are ge erally prevalent in soils of the Western Stat Results were apparent within 24 hours, and last 10 times as long as natural organic matter. Te conducted to date indicate that the condition have no toxic effects on soil micro-organisms a in most cases, do not appear to have any to effect upon plants. Certain harmful effects a suspected on potted plants, however.

But don't run to the store or call your sal man for a stock of the new soil conditioners. the first place, they are not yet available in t quantity which would be required for farm u In the second place, they are expensive, as w ıther developments such as 2,4-D, DDT and tetra-thyl lead, until mass production methods were levised. In the third place, much experimental vork remains to be done in order to determine the uantities to use under different conditions, the nethods of application for best results, and the ffects on different soils and crops.

Generally, 1 pound of synthetic soil conditioner er 100 square feet has been found effective for neeting soil erosion conditions. About 300 to 00 pounds of the synthetic are required per ropped acre. Soil-building effects take place at ow concentrations. If more than about 0.2 per-ent is used (about 1 ton for 3 acre-inches of soil) he results might be detrimental and quite the op-osite of the effect desired. Puddling and baking f the soil may be very pronounced. Consider-ng the strong fixation of the conditioners in the oil, severe consequences may result unless suitable conomical methods are developed to remove ex-ess concentrations. Soil should not be allowed o dry out completely. Once this occurs, it may e difficult or impossible to wet the soil again.

On cultivated lands, the powder forms may be pplied at the rate of 300 pounds per acre and vorked into the top few inches. For deeper ef-ects, 500 to 1,000 pounds per acre may be applied n two steps—one-half top dressed and plowed lown, and the other half disked in after plowing. They can be applied along with fertilizer in prep-ration for planting, and enough nutrients should e provided in the soil to take advantage of the etter growing conditions provided for the plants hrough the treatment.

On garden soils and in the greenhouse, the con-litioners may be used at the rate of about 1 pound er 100 square feet and thoroughly worked into depth of 3 inches. To control erosion, a care-fully prepared solution may be sprayed on the urface.

In all cases, the soil should be reasonably dry t the time of application. Some water is neces-ary after the treatment to permit the synthetic onditioner to act.

The powders must be stored in dry places with ontainers tightly closed since slow hardening nay occur in some climates. In mixing it with ther products, don't combine it with ammonium itrate. It might explode.

CONDITIONED SOIL LETS RADISHES GROW.—Untreated soil in photo No. 3 shrank and dried to a hard crust from watering. Treated soil in photo No. 4, watered in the same manner, shows greater germination resulting from synthetic soil conditioner.

Krilium, Aerotil, Fluffium, and other similar products are already on the market primarily for home garden use, but by next year, one company may have enough raw material available to make tens of millions of pounds if the market justifies this output. The commercial products consist of

(Please turn to page 212)

IRRIGATION MADE EASY.—At left, J. A. Fambro, ditch-rider, Carl Duke and Mark Rotliff watch water flowing over lower side of Duke's ditch. Above, Dee Inmon removes a concrete block from his box-type lateral.

FORT SUMNER'S CONCRETE LATERALS

by GARFORD WILKINSON, Region 5 headquarters, Amarillo, Tex.

"WE'RE THE LAZIEST BUNCH of irrigation farmers in the West and we're spending a lot of time and money to prove it."

So said Mark Ratliff recently as he adjusted his hat and sighted across the Waller brothers' 155-acre farm in the Fort Sumner, N. Mex., irrigation project.

"Take these Waller brothers, Dan and Forrest," Ratliff continued, "they have built concrete laterals so they can water their entire place in less than 24 hours and never soil their Sunday shoes."

Ratliff, president of the irrigation district, was showing radio and newspaper men the work farmers had accomplished since the Bureau of Reclamation completed its rehabilitation of the project in 1951. He took the visitors to several places to view concrete laterals, bench leveled farms and growing crops. Before the rehabilitation program, the project looked like a mule in buggy harness. But that's been changed. Fields and feed lots are spick and span. The homes and outbuildings are repaired and painted. The entire project is being dressed in party clothes and the change from the previous rundown appearance now reflects new pride of ownership.

The former privately financed and engineered Fort Sumner project had experienced innumerable difficulties from its very beginning in the 1860's up to the time landowners contracted with the Bureau to build a new diversion dam on the Pecos River and rebuild the main canals and drainage system. Previously constructed diversion dams were inadequate and the loss of water in the canals and farm laterals was a constant source of disappointment come harvest time.

Today, the Bureau-constructed main canal and many of the ditches serving the 6,500-acre project are concrete lined. Under the old set-up water from the Pecos flowed to farms in a dirt canal. Loss was estimated at about 50 percent in the 3-mile stretch from the point of diversion to the first turn-out. A great deal more of the supply was wasted in the poorly constructed, weed infested farm laterals. Now, the farmers receive virtually full use of the water. Only 45 minutes are required for it to move from the dam to the first farm ditch. It seems only a matter of seconds after one of the two ditch riders, J. A. Fambro or Percy Sweat, opens the gates to let the water enter a farm lateral until it is spreading out evenly over thirsty fields.

Project farmers early eyed the Bureau's engineering and construction methods. They decided that their individual farm distribution system ould be no less efficient. They summoned Soil onservation Service engineers to lay out farm terals. Some obtained financial assistance from e Production and Marketing Administration. everal received help from the Farmers Home dministration. Still others went about their isiness with different means. Dirt began to fly, ncrete laterals laced the countryside, and ferlizer spreaders moved across the leveled fields.

Forrest and Dan Waller designed their own stem. This lateral is a square-type, with peranent indentations or scallops on the top of one le through which water flows automatically onto e lands to be irrigated. Check gates control the w of water onto various fields. The concrete ned lateral drops two-tenths of a foot in each secn between check points.

The Dee Inman farm was more of a problem. man had to bench level his place in three tiers. e chose a box-type ditch with concrete blocks aced at regular intervals on the land-to-be-irrited side of his lateral. These concrete blocks n be removed easily to increase the flow of water rough indentations to any desired area. The man design, not greatly unlike the Waller degn except for the removable blocks in the innted border, also has a perfectly graduated drop tween check points.

Carl Duke built a V-type concrete lateral. He, e Inman, used the removable concrete blocks set the upper edge of one side of the lateral, but he ent one step further than Inman in the refineent of painless irrigation. He placed wire ndles in each concrete block to lessen the stoopg and lifting process. Obviously no siphons are

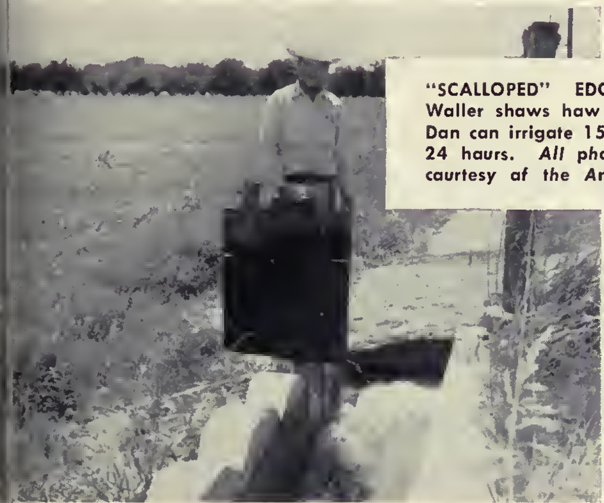
THEY SAVE TIME AND MONEY by spending time and money for more efficient structures. Here are the Fort Sumner Irrigation District officers: Sheriff Sam Martin, Mrs. Wilma White (secretary) and Mark Ratliff (president). Bill Mullins, other board member, was absent when this picture was taken.

required on any of the project's lined canals.

Although the project already is an oasis in the midst of arid rangeland in its second year of operation following Bureau rehabilitation, much work remains to be done before all of the 250 farmers will have virtually automatic irrigation systems like those of Dee Inman, Forrest and Dan Waller, Carl Duke, Mark Ratliff, Sheriff Sam Martin and others. However, numerous farmers are working toward the goal set by the pioneers of easy irrigating.

As the SCS completes its farm survey, construction of the concrete lateral system follows.

(Please turn to page 212)



"SCALLOPED" EDGE DITCH.—Forrest Waller shows how he and his brother Dan can irrigate 155 acres in less than 24 hours. *All photos for this article, courtesy of the Amarillo Daily News.*

DESCHUTES' "WEED HOLIDAY"

FOUR HUNDRED FARMERS AND BUSINESSMEN in 70 crews took a day off to destroy weeds on 200 miles of Deschutes' laterals during Reclamation's Golden Anniversary, June 17, 1952. ***All photos for this article by Stan Rasmussen, Region 1 photographer.***

by CARLOS RANDOLPH, Irrigation Manager, North Unit, Deschutes Project, Oreg., Region 1

FREEDOM FROM WEEDS is most important to the champion seed growers of the Deschutes project in eastern Oregon.

The farmers simply cannot afford to let weeds choke out their crops, steal water, or mix with their alfalfa and clover seed. That is why, since the beginning of irrigation on this project in 1946, weed control has perhaps attracted more attention than on other developments. More than half of the 50,000 acres of the North Unit of the project was in clover and alfalfa seed crops in 1951.

Deschutes is the project where the weedmobile was developed (see Deschutes Weedmobile, p. 3, January 1952, RECLAMATION ERA), where the farmers raise prize-winning, high-quality seed year after year (see Deschutes Project—Deep in Clover, November 1949, and Deschutes Does It Again, p. 92 of the May 1951 issue), and where on June 17, 1952—Reclamation's Golden Anniversary—400 farmers, businessmen, Federal, State, and county employees joined together in what may well be the greatest 1-day war on weeds in the 50-year history of Federal Reclamation.

During this "Weed Holiday," 70 crews, each under the direction of a farmer with a businessman as a "strawboss," covered 200 miles of laterals, locating, identifying, and destroying every weed known to exist on this project.

The entire lateral and canal system had previously been covered with mobile spray units, but the weed holiday was declared to promote weed consciousness and thus assure even better methods of control.

The idea of a "Weed Holiday" in which everyone could participate was conceived about a year ago, and was developed through meetings with the directors of the North Unit Irrigation District, the Jefferson Seed Growers Association, the Jefferson County Extension Service, and farm and business organizations. Eleven Bureau of Reclamation ditch riders, whose rides or beats cover the project, organized the farmers along their rides into several divisions, each division assigned to a certain farmer who became the leader of a crew composed of his nearest neighbors. Most farmers worked on laterals near their own farms or from which they received irrigation water. Businessmen from the project towns of Madras, Culver, and Metolius volunteered to help clean out the weeds.

The members of the 400-man army cut, hacked, and pulled away at every weed they could find, except for primary noxious weeds (white top, Russian knapweed, quackgrass, morning glory, and Canada thistle). The eagle-eyed crews spotted 1[illegible] hitherto unknown patches of these weeds, marked

HAT IS IT?—At left, farmers test their skill at weed identifica-
n during a contest. At right, County Agent Paul Barnes, at microphone, and Carlos Randolph demonstrate how to identify the "plants out of place" which threaten seed crops.

iem plainly for future destruction and reported iem to Bureau personnel. Curly dock and plan-iin especially got a rough going over. These are ie seeds which are difficult if not impossible to emove from Alsike or Ladino clover seed.

The work was completed by noon, when the vic-orious weed crews gathered at the recreation hall t Irrigation Headquarters for luncheon provided y the North Unit Irrigation District and served y the ladies of the Jefferson County Library Asso-iation. After luncheon, weeds were tagged with ieir most common names and placed on display or everyone to observe. Added to this Rogues allery were weeds grown in a hot house by the 'acific Supply Cooperative.

Prizes were awarded by the Jefferson Seed rowers Association to farmers Wiley Clowers and Art Carlson for their tying high score of 88 in the weed identification test; to businessman William Robinson and farmer Leo Bicart for bringing in a weed that could not be identified by Dr. A. N. Steward, head of the Oregon State College Herbarium, and his assistants, Mrs. Wiletta Smith and Dean Clarkson (later the weed was properly tagged as Agoseris species, commonly called summer dandelion or wild cotton); to farmer Jesse Gregg for bringing in the largest weed (a 71-inch curly dock) and to Art Carlson's crew for bringing in the largest variety, 24.

Probably the greatest accomplishment of the day was one of education. The people were surprisingly interested in weed identification and cer-

EXCELLENT GRASS COVER on canal and lateral banks of the North Unit, Deschutes project, in Oregon prevents weed infestations.

tainly more people are weed conscious than ever before. The farmers were in a position to observe the scope of the weed problem and understand that in order to have a successful weed control program everyone must do his part. No less important, public relations between the farmers and businessmen were strengthened. There is little doubt that the "Weed Holiday" will be an annual event.

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New Life for the Soil

(Continued from page 207)

one to two parts of the chemical to three or four parts of carrier, and cost several dollars per pound. Although the present cost sounds high, 1 pound does as much as 200 pounds of peat moss at 0.04 a pound, or 500 pounds of commercial compost at 0.025 per pound.

Lower costs for the synthetic soil conditioners may become possible with more efficient production methods, development of competing materials, and volume sales.

This is only a beginning, and research and practical experience in the development and use of these soil conditioners may disclose many new and wonderful ways to bring new life to both good and poor soils. ###

Fort Sumner's Concrete Laterals

(Continued from page 209)

Production and Marketing Administration con servation payments are available to cover a par of the costs of the irrigation structures, leveling and fertilizing. The Farmers Home Admin istration makes water facility loans to cooperating farmers for reorganizing farm irrigation systems.

Water is available to project users through th district's holding senior right to 100 cubic fee per second from the natural flow of the Peco River. The district's water passes through Ala mogordo Reservoir, constructed upriver in 193 to store a supply for the Carlsbad irrigation proj ect, about 160 miles downstream from For Sumner.

Principal crops are alfalfa, corn, cotton and vegetables, with some orchards. Cotton, which averages about a bale and a half per acre, is a minor crop. Alfalfa, currently selling at $35 pe ton, is favored by project farmers. The marke includes ranches in the area, feed lots, dairies and sales rings within a 150-mile radius of For Sumner.

Costs of the concrete laterals constructed to dat range from a low of $1.07 per running foot to a high of $2 per foot. The average project-wid cost is about $1.30 per foot.

Sheriff Sam Martin, who divides his time be tween farming and keeping law and order in New Mexico's De Baca County, says the idea of con structing concrete farm laterals is spreading throughout the project area like measles in a kindergarten. The sheriff also emphasizes th fact that night irrigation can be performed with out any form of lighting. Mark Ratliff was kid ding when he said Fort Sumner project farmer are the laziest bunch of irrigators in the West He could have been completely honest in the sam space of time had he said that he and his neighbor are wise and industrious. They're making i mighty easy to irrigate. Of far greater impor tance, however, is their program to conserve and use every drop of water allotted to them from th Pecos. ###

SHASTA SPILLS.—Shasta Dam's spillway went into action in late May this year for the first time in history, creating California's brand new waterfall as the 35-mile-long lake behind the dam filled and overflowed. The 487-foot waterfall is three times higher than Niagara Falls. Carla and Terry Benoit, on the lawn just below the 602-foot structure, demonstrate that they understand the basic principles of the "spill"—on a smaller scale.

Fishing at Boysen

SINCE THE FIRST OF MAY, the scene above has become more and more common, with fishermen completing a day with good catches of trout. At lower right, the dam and reservoir responsible for the added attraction.

FOR THE FIRST TIME IN RECENT YEARS, the Bighorn River in north-central Wyoming is offering excellent opportunities to trout fishermen, made possible by the recent completion of the Bureau of Reclamation's Boysen Dam midway between Thermopolis and Shoshoni.

In a period of a few short months, the reservoir forming behind the dam has become large enough to trap a very large portion of the heavy silt load of the river. The removal of the silt plus the colder temperature of the water resulting from sustained storage in the reservoir have made excellent trout habitat not only within the reservoir but in the Bighorn River for many miles downstream from the dam. These two factors and the recent planting of game-sized fish both in the reservoir and in the river below the dam brought Wyoming anglers flocking to the area on May 1—the opening day for fishing.

Constructed primarily to conserve wasted flood flows of the river for irrigation development and the generation of hydroelectric power, the Boysen Unit is typical of many units of the Missouri River Basin project in that the development plan calls for many beneficial uses to be served. Irrigation benefits from the unit consist of the provision of a stable supply of water for about 20,000 acres in pumping units along the river downstream from the dam and, by conserving water for downstream uses, the irrigation development of an additional 80,000 acres upstream from the reservoir. The 72,000,000 kilowatt-hours of electrical energy to be generated annually at the 15,000-kilowatt power plant will help to relieve a critical power shortage in the Big Horn Basin of Wyoming.

Boysen Dam was started in 1947. Late in 1951, final closure of the 230-foot-high, 1,100-foot-long earthfill dam was made. Soon thereafter the waters began to clear and the Wyoming Game and Fish Commission began planting trout in the reservoir and the river below the dam. Most of the fish planted were 6 or more inches long and of legal size for catching. So far more than 57,500 trout have been planted and this planting will continue until the 820,000 acre-foot reservoir and the river downstream from the dam are top fishing centers in the area.

Wyoming Fish Warden A. F. C. Greene said that an effort will be made to stock the stream with fish of as large a size as are available because of the extreme fishing pressure expected in the easily reached area, part of which is in the Wind River Canyon which annually attracts a great number of visitors with its scenic value alone.

In addition to its appeal to fishermen, Boysen Reservoir will make possible many new types of recreation to residents of the area. The presence of a sizable lake in a region of very few large bodies of water will draw visitors from an extensive area for boating and other water sports and picnicking and sightseeing at the reservoir will be enjoyed by thousands. ###

COLUMBIA BASIN'S SHOWPLACE

by HUGH H. MONCRIEFF

Columbia Basin project
Washington, Region 1

"DON'T WASTE THE WATER!" cautions Mrs. Dunn, as Sally hoses the bushes in the front yard. *Photo by Frank B. Pomeroy, Region 1 photographer.*

"It's a far cry from Hoeing sunflowers in Kansas."

That is what Donald D. Dunn says about operating his Columbia Basin farm 3 miles north of Moses Lake, Wash., where he is working hard to make it "the best farm in the United States."

The farm, valued at more than $50,000 (on which all the materials, labor, and land had been donated by business firms and private individuals) was given to Donald D. Dunn, picked in a national search by the Veterans of Foreign Wars to decide the most worthy veteran in the United States.

Presentation of the farm on May 29, and the building of it, was a feature of the 11-Day Columbia Basin Water Festival celebrating the start of irrigation on the 1,029,000-acre Columbia Basin project.

A great number of changes have taken place since the day after the farm was built, and the Dunn family awoke to start a new life. Even though the crops had all been planted, Dunn couldn't say, "Well, I guess I'll stay in bed this morning." No, he had work to do and plenty of it. He has been busy at it ever since. Some of the neighbors came over to help him during the first few days as water had to be put onto the newly planted land immediately.

Water, the precious substance which turns the barren areas of the Columbia Basin project into bountiful green fields, at times requires expert troubleshooting in the field. New ground broken for irrigation sometimes reacts violently when water is first turned into the ditches. Dunn, who formerly dry-land farmed in Kansas, survived the first few weeks and, with the help of a foreman experienced in irrigation, soon learned the capacity of his ditches and how much water was needed for his crops.

After getting over the first tough hurdles, they did not stop working even though the buildings were all completed and the fields planted. With the aid of hired help, they prepared and planted another 12 acres and built a corral for the seven cattle—6 head having been donated by cattlemen of the Pacific Northwest, and one a gift sent by the Governor of Texas to Barbara June Dunn, Reclamation's Golden Jubilee baby, born on June 5, 1952.

The hired hands on the farm during the month of July were unique—three German exchange agriculture students who had been studying here in the United States. Klaus Flack, 26, finished a year of study at Washington State College; Rupprecht Zapf, 25, and Wolfgang Gruber, 24, have finished a year at Kansas State College. These three, who must return to Bavaria in September, came out to look at this showplace for new farmers in the Pacific Northwest and were hired by Dunn.

"We fought on different sides during the war but that is all over now and I thought they were swell fellows," says Dunn. "That's just plain Americanism, isn't it?"

Dunn was particularly happy that Wolfgang Gruber had made poultry his specialty in school. The 500 chicks, just delivered to the farm, were

CONGRESS HONORS THE DUNNS

The Senate and the House of Representatives jointly commended Mr. and Mrs. Donald D. Dunn by passing the following Concurrent Resolution 214, introduced to the House by Henry M. Jackson of the State of Washington, reported by the Honorable John R. Murdock of Arizona, chairman of the House Committee on Interior and Insular Affairs, and submitted to the Senate by Warren G. Magnuson of the State of Washington.

WHEREAS the Congress and the President of the United States recognized the importance of water-resources development by enacting into the law the Reclamation Act of 1902; and

WHEREAS this and subsequent legislation has been the means of placing more than 6 million acres of land under irrigation and installing more than 4 million kilowatts of hydroelectric power on our rivers and streams; and

WHEREAS people everywhere in the West are joining this year in celebrating this Golden Jubilee of Reclamation; and

WHEREAS a principal celebration is being sponsored by the people of the Columbia Basin reclamation project and the State of Washington as a part of the golden jubilee celebration and also in honor of the first integrated operation of the great Columbia Basin reclamation project; and

WHEREAS Mr. Donald D. Dunn, judged the most worthy war veteran to be found in the United States, is to receive a farm fully developed and equipped, which has been provided by the people of the project as a part of the celebration; and

WHEREAS Mr. and Mrs. Dunn and family, displaying an earnest resolution not to let misfortune deter them from winning a stake in the land for which he fought, are typical of the strength of America:

NOW, THEREFORE, BE IT RESOLVED by the House of Representatives (the Senate concurring), That this Congress congratulates Mr. and Mrs. Dunn on the record of heroism and fortitude in the face of misfortune which has won for them this first family farm to receive irrigation water from the great pumps at Grand Coulee Dam on the Columbia River.

Passed the House of Representatives June 3, 1952.

giving the entire family a great deal of trouble. Wolfgang took the chicks on as his personal responsibility and with a change in the diet and an outdoor pen, they were soon on the way to being future money producers.

Donald D. Dunn has not always seen the bright future that is now before him. At the age of 17 he had to quit school in the middle of his senior year at Marion High School, Marion, Kans., because of illness in the family. He entered military service when he was 21 where he drove a tank for the Seven-hundred-seventy-first tank battalion, the first American outfit to cross the Ruhr. He says he guesses he was a pretty good soldier, but he was surely looking forward to getting back on the farm, and to his high school sweetheart, Vernetta Jean Seifert, whom he had married after he was in the Army 6 weeks. He postponed the wedding until that time because he didn't want

A WELCOME FLOOD of gifts and commendations poured on one-time flood victim Donald Dunn during hearings before the House Interior and Insular Affairs Committee in Washington, D. C. 1. Dunn and Secretary of the Interior Oscar L. Chapman. 2. From left to right, Representative Henry M. Jackson, Dunn, Representative Hal Homes, and Representative John R. Murdock. 3. William E. Welsh, secretary-treasurer of the National Reclamation Association, presents gold-plated irrigation shovel and other gifts for the NRA's adopted Golden Jubilee baby, Donald Dunn's daughter.


1


3


2

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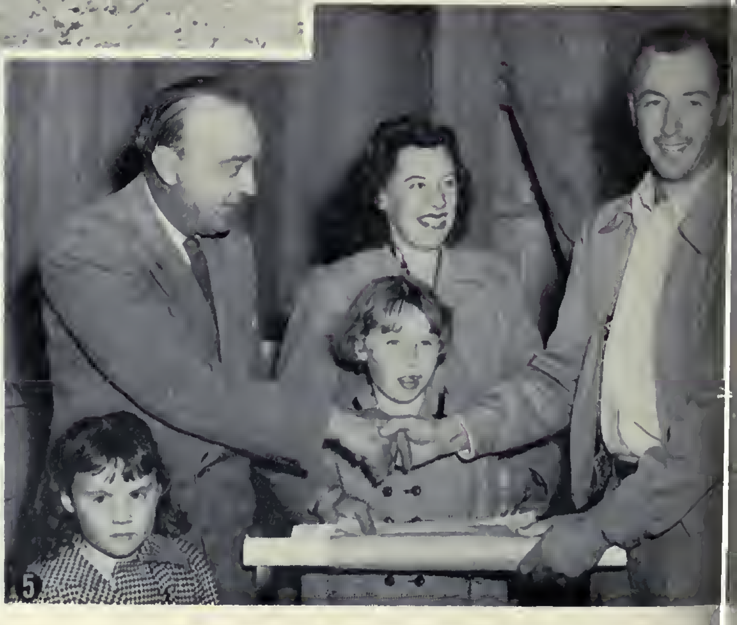
OFF TO A NEW START.—With a farm and
built in a day (1, 2, and 3). Commiss
Michael W. Straus hands irrigation shov
Dunn as first water is delivered. Former U
Secretary of Interior Richard D. Searles, stand
tween them (4). Hubert H. Walter, chairm
Columbia Basin Water Festival, presents the
to the farm in-a-day (5). Dunn at work
The new baby, Barbara June (7). The
house (8), where daddy reads the pa
Deanna sits on the floor, Mrs. Dunn hold
baby, and Sally flirts with the photogra
*Photos 2 through 8 by Frank B. Pomeroy; N
by Ellis E. Shorthill, both Region 1 photograp*



anyone to think he was trying to avoid the draft by getting married. There may have been times when he thought he would never get back to his wife and farm in Kansas. He was one of only two tank drivers out of the original overseas outfit who was not either killed or wounded.

After 3 years, 3 months and 1 day of service, he was honorably discharged at Fort Smith, Ark., with the rank of sergeant, having received three battle stars and ribbons for each theater of operation.

He then rented a farm near Marion, Kans., where he took advantage of the GI bill to get 3 years of on-the-farm training. He demonstrated his progressiveness as a farmer by planting test plots of wheat and hybrid corn, going into partnership with a neighbor to purchase a hay baler, and handling all of his own hay in addition to about 10,000 bales sold each year. Wheat, corn, and alfalfa hay were his main crops, but he kept a few head of dairy cattle, and either a herd of beef cattle or feeder lambs during the winter, plus hogs part of the time.

Everything went well. A daughter, Deanna Jean, was born, and then on December 10, 1946, the Dunns became the proud parents of twins, a boy and a girl, named Gary Don and Sally Ann. But the boy died of pneumonia at the age of 3 months—a great shock to the young couple.

On July 8, 1951, 6 years after his discharge from the Army, Donald Dunn could see all that he had dreamed and worked for coming true—he had 400 acres of rented land, 20 years of farming "know-how," a wonderful wife, two fine children, was happy and comfortable, looking forward to a good crop, with hardly a worry in the world.

The next night, the bottom dropped out. Dunn's crops, livestock, and much of what he owned went swirling down the raging Cottonwood River. It was the 1951 Kansas flood, the worst catastrophe in Kansas history—and the Dunns were in the middle of it. The family drove to Marion when the water started to threaten the farm, but when Dunn heard his neighbor was among the missing, he went to the rescue in a motorboat, finding the neighbor, his wife and three children, marooned on a small island—once a hill,

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A FAIR EXCHANGE.—Dunn shows his three hired hands how to couple a sprinkler irrigation pipe. Rupprecht Zapf, Klaus Floch, and Wolfgang Gruber, exchange agricultural students from Germany, help with their know-how, Gruber having saved Dunn's 500 chicks. *Photo by Frank B. Pomeroy, Region 1 photographer.*

WILL THIS LAND GROW CROPS SUCCESSFULLY?—That's what Bureau land classifiers must determine before Uncle Sam invests public funds in Reclamation works like the Roza Canal of the Yakima project, below. ***Photo at left of sagebrush in the Snake River country near Mountain Home, Idaho, by Ben Glaha, Region 2. Photo below by Stan Rasmussen, Region 1.***

Land Classification and Construction

by E. N. POULSON, *Soil Scientist*, and L. R. SWARNER, *Irrigation Engineer*, Boise, Idaho, Region 1

Part 8 in a series of articles on soils and land classification

Today, in our Western States we see broad expanses of productive, irrigated crop lands occupying areas which a few years ago were covered by sagebrush and other native vegetation. The transformation of this vast area of desert into rich productive farm lands through the application of life-giving irrigation water is a tremendous task.

Many people might look at a broad panorama of level or gently rolling raw sagebrush land and think it would be ideal for irrigation development. It is not as simple as that. Before you can draw up sound, coordinated plans for project development, you have to know about the climate, whether the land can produce crops under irrigation, whether the people could raise and market enough farm produce to help pay for the necessary construction, and whether efficient, feasible works could be built to store and deliver the water.

Land classification has become more and more important in determining these things before a project is developed. Its primary and most important function is that of segregating this broad expanse of desert land into areas which are suitable for agricultural production under irrigation, and areas which because of their physical limitations will be unable to sustain profitable irrigated agriculture, or will be too costly to develop under existing and anticipated economic conditions.

For example, some lands might be located at such a high elevation that it is not economically feasible to supply water under present costs. They would be eliminated from the project area, through the process of irrigable land selection. Shallow depth of the soil or the presence of excessive amounts of salt which cannot be leached may limit the use of other lands to the extent that they will not provide a satisfactory level of living for a farm family after production, operation, and maintenance expenses and a reasonable share of project construction costs are met. The topography of some of these lands may also render them unfit for irrigation. Thus, not until a land classification has been made is it possible to determine e extent and location of the lands suitable for rigation in these vast expanses of arid land.

Perhaps at some future date, it may become asible to serve these high lands with water. Im-oved methods of land development, such as the e of modern, heavy-duty machinery; more eco-nmical and efficient methods of lifting water, ch as low-cost power and improved pumps; ad-ncements in plant and soil sciences, such as the velopment of salt-tolerant varieties of crops d low-cost effective soil conditioners, or some her economic changes—all these or a few of ese things might permit profitable development lands now considered unsuitable.

On operating irrigation projects in the West, any of which have recently provided homes and velihood for veterans, the information obtained om land classification has supplied basic data r irrigation development. Through careful aluation of the soil and land characteristics, itable land areas for irrigation are selected. ll crop production and development depend on the water supply available from direct di-rsion or storage. It is, therefore, necessary to termine the water requirement or the amount water necessary to adequately irrigate the land.

In determining this requirement, we try to fig-re the amount of water per acre which the farmer eds and can beneficially use, both with respect yields and profitable returns, from the cropping rogram forecasts and with respect to the con-rvation of soil and the prevention of excessive epage. There are many climatic and agronomic factors which enter into this determination, such as the length of growing season, annual precipitation, and the cropping pattern to be followed on the developed irrigation project.

The nature of the soil is very important in the determining how much water is required. Fine-textured soils have a higher waterholding capacity than the coarser-textured soils, and the deeper soils have a greater storage capacity than the shallower ones. Whatever is learned about the soil during the land classification has a definite bearing on the irrigation methods and practices which the farmer will put into effect. The manner in which the water is used has a great deal to do with the total amount which will be required.

When available moisture capacity of the soil is the critical limiting factor (as in the soils on the Yuma Mesa in Arizona and most of the soils on the East Mesa of the Imperial Valley lands in California), it is a major factor in the land classification standards. On the vast Columbia Basin project in the State of Washington, four different types of land, designated as water-duty classes, were recognized on the basis of the textural profile characteristics determined in the land classification. Each of these classes, because of available moisture capacity and other physical properties, will require specific amounts of water for crop production. For each class, an annual water allotment has been recommended.

This farm delivery water requirement, together with the amount necessary to offset the anticipated

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UILT TO FIT THE FARM.—The farm unit and field lay-out on the asco Unit, Columbia Basin project, Wash., was determined with e aid of land classification to take advantage of the natural pography and achieve maximum production.

SPRINKLERS FOR SANDY SOIL.—The Winchester Development Farm of the Columbia Basin project, Wash., was prepared for sprinkler irrigation because of the sandy nature of the land. ***Photos at left and right by H. E. Foss, Region 1.***

DISTINGUISHED SERVICE MEDAL is pinned on Moritz's lapel by Senator Ernest McFarland of Arizona (at right) at Boulder City. *Photo by John Santa, Region 3 photographer.*

Reclamation's Hall of Fame

Nomination No. 14

ERNEST A. MORITZ
"Mr Reclamation"

by **WILLIAM J. WILLIAMS, Information Officer, Region 3, Boulder City, Nev.**

"Mr. Reclamation—dean of the regional directors. That's Ernie Moritz."

So stated Reclamation Commissioner Michael W. Straus, during the presentation of the Department of the Interior's highest honor, the Distinguished Service Award, to Ernest A. Moritz, who retires this fall after 31 years as a Reclamation engineer-administrator. The award ceremony, in which Commissioner Straus, then Under Secretary of Interior Richard D. Searles, and Arizona Senator Ernest McFarland participated, was held last April 30 almost within a stone's throw of Hoover Dam over which Moritz has had supervision during the past decade.

Commissioner Straus titled Moritz "Mr. Reclamation" because he typifies men such as Newell, Davis, Savage, Banks, and other Reclamation greats with whom he shares Reclamation's Hall of Fame. These and many other "Mr. Reclamations" have tamed the western rivers to irrigate over 6 million acres of land and generate hydroelectric energy at the present rate of over 23 billion kilowatt-hours annually.

When Ernest A. Moritz started his Reclamation career 47 years ago, engineers relied largely on their good eyesight and good judgment. There were no well-equipped laboratories and elaborate instruments such as are used today. Nevertheless these early engineers built, along with their dams, reputations that have stood strong through the years. The Bureau of Reclamation is recognized the world over as the greatest engineering organization of its type, and certainly Ernie Moritz has helped to make it that.

Ernest A. Moritz was born August 30, 1882, in Sheboygan, Wis. He received a B. S. C. E. degree in 1904 from the University of Wisconsin. Awarded a scholarship for further work at the same university, he completed requirements for his civil engineering degree a year later.

He accepted a summer job in 1905 with the fledgling Reclamation Service, created after passage of the Reclamation Act on June 17, 1902, and was assigned to the Garden City project in Kansas. Normally a semiarid area where irrigation for successful agriculture over a long period is a "must," the early years of the project proved to be an exception. The rains came, and the farmers decided they didn't need an irrigation system, so the irrigation works eventually were sold to a private concern.

The young engineer shook off the Kansas rains and in the fall returned to the University of Wisconsin, where he was instructor in applied mathematics for three semesters. He wrote the first bulletin published by the university on reinforced concrete. Leaving the university, he worked for a short time with the C. M. & S. & P. R. R. at Chicago, Ill., in its bridge and building department.

Reclamation proved "right as rain" on his next assignment, which took him in April 1907 to the Yakima project in Washington as assistant engineer. Soon he became engineer in charge of ll engineering work on the project's Sunnyside unit. There he rehabilitated the private irrigation system on 30,000 acres acquired by the Government and enlarged and extended the system to over 100,000 acres of land in the Yakima Valley. He also investigated dam sites and storage requirements for Yakima Valley irrigation and made reconnaissance surveys and reports on future extensions.

When Moritz visited the Yakima project last year he found the structures he had built in those early years still sound and performing their functions. The Yakima project is one of the most successful of the Reclamation projects to date. Its 87,500-acre Tieton Division was the first major unit of any Reclamation project to repay in full its construction costs to the Federal Government. Moreover, the Yakima project's annual crop production is one of the highest of all Reclamation projects.

Upon arriving in Washington in October 1912 to serve on F. N. Newell's staff he was given charge of the monthly publication of the service, then known as the Reclamation Record, a forerunner of the RECLAMATION ERA.

Editing the magazine was strictly a side duty, as at that time the Record was devoted almost entirely to technical articles, and Moritz recalls that he always had on hand a wealth of material prepared by engineers. When he needed to fill up space, he would reach into a pigeonhole for an article of the right length. The Reclamation magazine since it was first published in 1905 has undergone numerous changes, and is now published primarily for water users on Reclamation projects.

On the Washington staff, Moritz had charge of engineering plans, specification and contract analysis and review. He was the first to recognize the value of experimental investigations and their practical application—an activity now carried out in the Bureau of Reclamation's Denver laboratories, largest of their type in the world.

In August 1915 Moritz transferred to the newly established office of design and construction at Denver. There, under the late F. E. Weymouth, he organized the engineering section and supervised all office engineering, preparation of plans and specifications, contract review, and general administrative work involved in the design and construction of Reclamation projects.

Moritz left Denver in March 1920 to become project manager of the Flathead project in Montana. He resigned in April 1921 to enter private practice with his brother, C. J. Moritz, of Effingham, Ill. During the next 13 years, under the firm name of C. J. Moritz, Inc., he was engaged in municipal engineering and heavy construction work on buildings, highways, streets, bridges, sewers, and dams.

He returned to the Bureau of Reclamation in 1934 as engineer at Parker Dam. A year later he became construction engineer, and by 1938 he had the dam substantially completed. With 235

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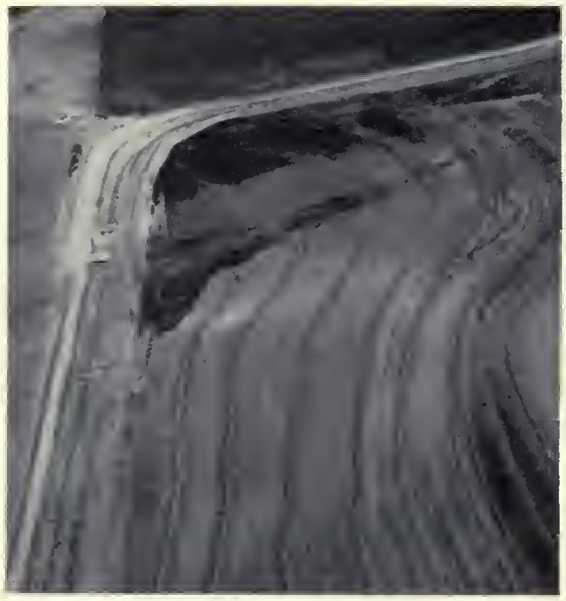
HIGHEST AND DEEPEST.—Hoover Dam, at top, right; and Parker Dam, below, represent the highest and deepest of Reclamation dams, on both of which Moritz worked. ***Photo at top by James Major; photo at bottom by George O. Bonowit, both of Region 3.***



WHEN THE WATER COMES TUMBLING DOWN.—The steep cultivatec field above the canal at left will be protected by the terracing, contou farming, and drainage inlet into the canal. At right, a canal wit no such terracing or other erosion control on the slopes in the back ground. *Photos submitted by the author.*

CONTROLLING UPLAND RUNOFF

by BEN W. HARRINGTON, Secretary-Treasurer, Bostwick Irrigation District, Superior, Nebr.

Controlling upland runoff is a comparatively new problem to the Bostwick Irrigation District of Nebraska but old to some of the longer operating irrigation districts.

Side hill runoff is a very serious problem in the Republican River Valley where much of the irrigated land is on the terraces and bottoms above the river. These terraces and bottoms are traversed by numerous natural drainage channels, both large and small, which carry storm runoff water from the uplands. The uplands in this area are characterized by a very rolling topography, the bulk of which is under cultivation, and a type of soil which is very susceptible to erosion. Annual rainfall for the area as a whole averages approximately 23 inches—most of which falls during the spring and summer months when thunderstorms are the rule.

The canals serving the irrigated lands must be protected from the upland runoff as well as the distribution system and the project lands below the canal.

To provide this protection involves, in general, the construction of:

1. Intercepting drains directly above the canals and laterals which intercept side hill runoff from adjacent lands and carry this runoff to natural stream channels.

2. Drainage structures (culverts or overchutes) which pass runoff water carried by the smaller streams under or over the canals and laterals.

3. Siphons which carry irrigation waters under the larger natural streams.

4. Surface drains or other necessary flood control works to protect project lands.

If the irrigation district is going to continue t function, these drainage works must of course b maintained. This one item has been an aggravat ing and expensive problem since the beginning o irrigation. At the best, the drainage ditches can not all be designed to prevent silting or scouring under all conditions. Further, the general topog raphy combined with abnormal rainfall, which occurs in the central western area and arrives in unpredictable amounts at times, acts as a costly hazard to areas requiring drainage ditches an maintenance of these drains.

There are many things which create a wid variation in the requirements of drainage ditches. Thus a season with normal rainfall might tax th absorbing capacity of the soil to the limit. The we might expect a sudden rain in the amount o to 5 inches, most of which would happen within time period of 30 minutes to 1 hour. You can eadily see how, under the above conditions, the teep-rolling uplands would cast large amounts of unoff into the man-made drains and overtax their apacity.

The engineers anticipate these occurrences and ndeavor to outline or design a drain or drain sysem to control actions of this nature. Neverthess Mother Nature creates other "freaks" or abormal conditions with which our most learned cientists must contend.

I personally recall very vividly the flood that ccurred in the Republican River valley in 1935, aused by perfect timing of tributaries emptying heir flood waters into the Republican River, all f which was an accumulation of excessive upland unoff water covering eastern Colorado, northvestern Kansas, and southwestern Nebraska. Then there are cases where existing topography nakes it impossible or infeasible even to approach so-called perfect design. Hence, drain mainteance is a necessary evil.

It is possible for the engineers to minimize the couring or gullying in the drains themselves hrough the use of drops or other structures. However, the engineer does not have control of he amount of runoff and, more important, the volme of sediment which enters the drainage system rom the lands above. In addition, he must design or the conditions which will be in existence at he time the irrigation system is to be constructed.

If a complete land management program to preent erosion and excessive runoff from agriculural lands above the canal could be put into effect prior to the design and construction of the irrigaion system, the construction costs could be mateially reduced, as well as the maintenance requirenents for operating the system. It becomes more and more obvious that the program of soil conservation and water retardation on upland areas is recommended by the Department of Agriculure and installed by the soil conservation districts s an important aid to the economy of the irrigaion districts. It seems that we cannot emphasize too strongly the need for a full and complete cooperation between the operators of lands above the irrigation canals, that contribute runoff waters, to work with our soil conservation districts, other agencies and the irrigation districts, for a purpose that will be of great value to them in retaining the soil fertility of their lands and at the same time not allowing thousands of tons of highly productive topsoil to be wasted into the Gulf of Mexico.

It is logical to assume that maintenance costs on a drain are in some proportion to the size of the drain. For example, a 20-foot bottom drain will require more maintenance dollars than a 10-foot drain, all other conditions being equal. In many cases the difference between no watershed control and complete control would mean such a difference in design. However, with complete control, the drain would not only handle less runoff water but would transport a much smaller percentage of silt which could settle out and fill up the drain.

In many areas wind is a cause of expensive maintenance, as soil and weeds which blow into the ditches have to be removed each year. Again the solution of this problem is in the hands of the soil conservation districts, the irrigation districts, and the landowners who must tie down the soil and keep it out of the irrigation ditches. Although under the best of conditions this cannot be eliminated entirely, better farming practices are the answer to the wind problem. ###

Interior Shifts Secretariat

Robert M. McKinney of Santa Fe, N. Mex., and Joel D. Wolfsohn of Chicago, Ill., were recently nominated by President Truman as Assistant Secretaries of the Interior.

Vernon D. Northrop is now Undersecretary of the Interior, replacing Richard D. Searles, who resigned to enter private business. Otis Beasley, former Budget and Finance Director, succeeded Mr. Northrop, as Administrative Assistant Secretary. •

New Names for One Dam and Two Lakes

Congress recently named or changed the names of the following:

South Coulee Dam on the Columbia Basin project in Washington is now named *Dry Falls Dam.*

Chief Joseph Reservoir to be formed in back of the Chief Joseph Dam in Washington is to be called *Rufus Woods Lake* (see Reclamation's Hall of Fame, Nomination of Rufus Woods on p. 236, December 1949 Reclamation Era).

Medicine Creek Reservoir in Nebraska is to be called *Harry Strunk Lake* (see Reclamation's Hall of Fame, Nomination of Harry Strunk on p. 195, September 1949 Reclamation Era).

WHEN YOUR HEART IS IN YOUR WORK, Martha Baumann proves you can live a healthy, happy, and prosperous life.

SUCCESS IS THE RESULT of courage, energy, and the true pioneering spirit. Miss Baumann and her profitable poultry.

WOMEN OF THE WEST

Martha Baumann—34 Years on the Newlands Project

"I'M GOING TO TAKE LIFE EASY for a while," said Martha Baumann, pioneer homesteader and progressive irrigation farmerette of the Newlands project in Nevada.

Bryan L. Harris of the Lahontan Basin area office of the Bureau of Reclamation was visiting her, and this statement nearly rocked him back on his heels.

Martha Baumann is well known around Newlands, known for its many "firsts"—having been among the first five projects to be authorized for construction by the then Reclamation Service and, the first to receive irrigation water. Martha has quite a few "firsts" of her own. She owned the first tractor in the Fallon, Nev., area. She worked with Fallon's first farm advisor L. E. Cline, and took the first bunch of 75 4–H Club children from around Fallon to summer camp in Reno.

At the age of 18 she and her brothers moved to the Newlands project where Martha was the leading and guiding force which helped them to weather the tough years on the bleak, sagebrush covered land near Fallon.

She herself homesteaded the 80-acre farm she now owns, laying the foundations for her home, and helping to build it from floor to rooftree.

She has ridden the range with her sheep at night, riding back to the modern dairy in time to milk the cows in the morning. Incidentally, she has a grade A milking barn with the best in electric milking equipment and until very recently was milking 23 high producing Holstein cows. She has out-stubborned that stubbornest of animals—the mule— when at the age of 19 she and her brothers got 10 of the onery critturs to "help" them level their land. As the story goes, she just tied the reins around her waist, and got the job done.

For years, in addition to her dairy business, Martha has raised fruits and vegetables, disposed of her eggs and poultry through the local Fallon cooperative, and been an active member of the Farm Bureau's Board of Directors in Churchill County. The night before she was interviewed she had traveled 75 miles to attend a meeting of the Milk Producers Organization.

Martha Baumann—"taking it easy?" The idea seemed a little on the impossible side. But she plied that she was going to try it, for a change, d her first experience along that line would be visit back to the old friends and relatives in regon City, whom she had not seen since 1916. As a teen-ager she had wrestled with a home-ad, and for 34 years has waged a steadily win-ng fight for a good living. Never having had a llege education, she "learned by listening" and ade a success of her 80-acre ranch-farm. This ccess was not achieved without many long hours work. With irrigating, caring for her livestock, ending to business and community affairs, she s often worked around the clock. She has ex-rienced many hardships and disappointments, such as the night coyotes killed 20 of her prize chickens, and the time 2 of her best Holstein cows died from bloating on alfalfa.

She has not sold her farm, and her 3 brothers who own and operate farms on the Newlands project will take care of it during her absence.

Many youngsters leave the home town to seek their fortune and dream of the day they may return, the fortune won. Martha Baumann's dream came true. Despite the hard work, the hardships, and the heartbreaks, she claims she wouldn't have missed a minute of her 34 years on the Newlands project, "for anything." ###

Columbia Basin's Showplace

(Continued from page 217)

e only spot of ground above water in the area. he oldest boy and girl had their hands over their rs to keep from hearing the baa-ing of the owning sheep—as Dunn says, some of the sheep re their 4–H projects, "which didn't help matters uch."

When the Dunns returned to their own farm veral days later, they found everything covered th muddy slime. The brooder house which con-ined 350 3-month-old chicks had washed away. ly two chickens escaped by resting in the top anches of a tree. When the Dunns opened the or of the laying house they found all the hens owned with one notable exception—a valiant rvivor who had proudly laid an egg on a soggy le of hay! All other livestock had perished.

In the house, everything below the 3-foot level s a mess. The furniture was ruined, and mat-esses so waterlogged that several men struggled carry them out. After scrubbing the interior til their fingers were raw and disinfecting every-ing, they moved back in, after 2 weeks, but it s some time before the musty flood smell was ne. About the only things saved were the motor-iven machines, which Donald Dunn had provi-ntially moved to higher ground the day before e flood.

After making a thorough survey of the damage, unn decided to salvage all he could, sell every-ing to pay off his debts and start all over. Like any pioneers before him, he went West, moving Yakima, Wash., where his aunt Mrs. E. K. Cher-ngton, lives. He got a job as a salesman for rm equipment, but the longer he worked, the more he realized that he would much rather use the machinery than sell it.

When he heard about the farm-in-a-day, he thought he might give it a try. After all, there were no cows to milk, no farm chores to do after a day of salesmanship, so he, with the help of his wife, just started writing. The rest is now history.

The frequent visitors to Donald Dunn's farm (in a 2-hour period 117 cars were counted) find that it is continually changing. Even the cropping pattern has changed from that shown in the May 1952 issue of the Reclamation Era. The once dry desert land has become a green carpet of beans, clover, oats, alfalfa, and potatoes. Dunn is emphasizing more crops to be utilized by the dairy herd he hopes to start this fall, and is developing an additional 12 acres of low land himself, planting it to oats.

Donald D. Dunn and his four hired hands have a great job cut out for them. The crops, planted almost simultaneously, all need attention at the same time. Irrigation sprinkler pipes must be changed, ditches maintained, and stock taken care of. Dunn intends using the soil to the best advantage by using the best known methods of crop rotation and other farm utilization methods.

Donald D. Dunn and his family, Mrs. Dunn, Deanna, 9, Sally 6, and the baby Barbara June, 3 months, realize that they were extremely lucky to have been chosen to be owners of this show place of the Columbia Basin project. Dunn intends to keep it as an example of what can be done on the land of this area with the aid of a little water.

The eyes of the Nation and in particular the eyes of the farmers and future farmers of the Columbia Basin project are on Donald D. Dunn and his family. ###

Land Classification and Construction

(Continued from page 219)

losses in transporting the water to the farms, such as evaporation, and canal and lateral seepage losses, represents the water requirement for the project. Storage dams which impound the waters during the runoff season for the irrigation season's supply are designed in full cognizance of this factor.

Often the watershed does not provide enough water to irrigate the entire amount of arable land delineated by land classification in the area. It is then necessary to choose carefully the lands which, in consideration of all other economic and engineering factors, will comprise the irrigable area. In reducing the acreage, the less desirable lands, as determined by the land classification, are eliminated.

The land classification map, showing the location and extent of the irrigable lands, guides the engineer in locating the system of canals and laterals, as he endeavors to provide water for as much good land as possible through an adequate system at the lowest possible cost. Rocky areas in which construction costs are generally quite high are isolated on the map and may be avoided. Also, canal sections through open, porous soils where seepage losses are frequently excessive ma be avoided or plans made to take them into ac count. The extent of the network of canals an laterals is determined by the acreage of land whic is to be served as well as by the method of deliver Likewise, the size and type of structures are deter mined, in part, by the amount of water which wi be delivered to the land.

On the 50,000-acre North Unit of the Deschute project, which has just been completed in centra Oregon, the soils are generally of a coarse texture Because of their relatively high infiltration rate, i is desirable to spread the water over the soi rapidly to avoid overirrigation and excessivel deep percolation losses. Here, large deliver structures have been installed and water deliverie will be made on a modified demand system whic will allow the farmer to irrigate his farm in a period of a few days.

Certain soils erode more easily than others whe exposed to a stream of moving water. By usin the land classification data, the engineer is able t design the canals and laterals to keep the velocit of flowing water below an erosive rate in th various textured soils.

(NEXT MONTH—LAND CLASSIFICATION AND FARM DEVELOPMENT.)

Ernest A. Moritz

(Continued from page 221)

feet of its 320-foot height below river bed, Parker is the deepest dam in the world.

In 1938 Moritz switched from the Colorado River of the Pacific Southwest to the Colorado River of Texas, where he was construction engineer on Marshall Ford Dam near Austin. With the job finished in 1941, he returned to the other Colorado River as director of power, Boulder Canyon project, at Hoover Dam, with headquarters in Boulder City. During this period several additional generators were installed and Hoover Dam boasted the largest power installation in the world.

Hoover Dam, rising 726 feet above bedrock, is the highest dam in the world. Moritz is the only person who has had direct supervision over both the world's highest (Hoover) and deepest (Parker) dams.

The Bureau of Reclamation was regionalized in 1943, and Moritz was named director of Region 3, comprising southern California, southern Nevada most of Arizona, and small portions of southern Utah and western New Mexico, with headquarter at Boulder City, Nev.

Throughout his career he has wasted few word or actions. Once he has spoken, there is never doubt as to how he thinks.

Moritz can be as witty as he can be seriou His sense of humor has endeared him to all wh know him. The light side of a subject brings twinkle to his eyes and a broad smile to his lip

His love of simplicity and informality is see in his streamlined organization throughout Re gion 3. He practices the theory that the shortes distance between two points is a straight lin Modesty is one of his most apparent virtues. H would never tell you of his own fame, and he is i at ease when he is in the spotlight.

Ernest A. Moritz retires from regular Govern ment service this fall, but you can be sure he is n retiring from usefulness. He will be on call b the Bureau of Reclamation as a consultant an might even write a book on Reclamation. ###

~~R~~eclamation's Construction Program Includes 10 New Starts

Congress reaffirmed its belief in the water users of the West and the soundness of the Reclamation program by authorizing the construction of 10 new projects, to inaugurate the second half century of Reclamation, when it passed the Interior Appropriation Bill which President Truman signed on July 9.

The 10 new projects, for which $14,950,000 was appropriated as a start, are tabulated below.

Specifications were issued early in July for initial work on 2 of the 10 new projects: Tiber Dam, a principal feature of the Lower Marias Unit of the Missouri River Basin project in Montana; and 5 wells on the North Side Pumping Unit of the Minidoka project in Idaho. Bids on these jobs were opened last month, August 12 and 14, respectively. The Bureau has set up a schedule for issuing specifications to cover initial work on the 8 remaining projects so that some work will be in progress on all projects on or before the first of next year.

In accordance with established Reclamation policy and congressional endorsement, certain requirements must be met before the dirt begins to fly on these new projects. These include the completion of soil surveys and land classification, to make certain that the lands to be irrigated are capable of producing crops under irrigation, and an over-all definite plan for the orderly development of these projects.

The $240,000,000 budget for the Bureau also includes funds for 73 projects now under construction which by next June will supply 267,000 more acres with irrigation water, bringing the total to 6,400,000 acres, and increase hydroelectric power, by 346,000 kilowatts, bringing the total installed capacity of Reclamation plants to 4,600,000 kw. The gains are mainly on the Central Valley, Colorado-Big Thompson, Columbia Basin, Hungry Horse and Missouri River Basin projects. Also scheduled is the second barrel of the San Diego aqueduct under contract with the Department of the Navy.

Project	State	Amount appropriated	Programed for early construction
Sly Park Unit, Central Valley project	California	$1,250,000	Camp Creek Tunnel, and Access Road, Camp Creek Diversion Dam, Sly Park Dam.
North Side Pumping Unit, Minidoka project.	Idaho	150,000	5 wells and lateral systems.
Solano project	California	3,000,000	Monticello Dam, Putah Diversion Dam, Putah South Canal.
Savage Rapids Dam	Oregon	700,000	Rehabilitation of Savage Rapids Dam.
Weber Basin project	Utah	1,350,000	Gateway Tunnel, Wanship Dam, and Gateway Canal.
Kennewick Division, Yakima project	Washington	1,500,000	Chandler pumping plant and associated power plant, Chandler Power Canal and Main Canal.
Rapid Valley Unit, Missouri River Basin project, Cheyenne Division.	South Dakota	1,000,000	Pactola Dam and Reservoir.
Lower Marias Unit, Missouri River Basin.	Montana and North Dakota.	2,500,000	Tiber Dam.
Missouri Diversion Unit, Missouri Souris Division, Missouri River Basin project.	Montana, North Dakota.	2,000,000	Dam and power plant.
Webster Unit, Solomon Division, Missouri River Basin project.	Kansas	1,500,000	Webster Dam.

Salt Water Conversion Program Under Way

A public-private salt water purification research program was launched when Congress appropriated $125,000 for coordinating as much data as possible to determine the best and cheapest method of making fresh water out of salt water.

The high cost of all known methods prohibits processing salt water for wide scale use on irrigated farms, in industries, and in coastal cities in water-short areas. In addition to seeking effective and economical methods for these purposes, the program will also look into the possibilities of purifying brackish and alkaline waters in inland areas to supplement the irrigation supplie throughout the 17 Western States.

Secretary of the Interior Oscar L. Chapman who was given responsibility for carrying out the program, has designated Assistant Reclamation Commissioner Goodrich W. Lineweaver as his representative to head the activity. The Secretary has instructed all Interior agencies dealing with water resources to cooperate with Mr. Lineweaver and make available to him all data on salt water conversion. Mr. Lineweaver has formed an advisory group of top-ranking leaders of educational, scientific and other agencies, public an private, as the initial step in getting the program under way.

NOTES FOR CONTRACTORS

Contracts Awarded During July 1952

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contrac amount
DS-3714	Columbia Basin, Wash.	July 21	10 motor-driven, vertical-shaft, pumping units for Ringold relift, PE-62, PE-64, PE-65, PE-64 relift, and PE-64C pumping plants, area P-8, Potholes East canal laterals.	Fairbanks-Morse & Co., Kansas City, Mo.	$37,03
DS-3726	Kendrick, Wyo.	July 14	1 lot of bulkhead-gate seats and guides, 6 9-foot 1¼-inch by 10-foot 8-inch bulkhead gates, 1 lifting beam, and 4 draft-tube filling valves for Alcova power plant.	Schmitt Steel Co., Portland, Oreg.	15,77
DC-3731	Missouri River Basin, Wyo.	July 10	Constructing auger, pad, caisson, and timber-pile footings, and erecting steel towers for Fort Randall-Sioux City 230-kilovolts transmission line, schedules 1A and 2.	Lipsett, Inc., New York, N. Y.	1,657,7
DC-3734	Gila, Ariz.	July 25	Construction of earthwork, concrete lateral lining, and structures for unit 2, Mohawk distribution system.	Macco Corp., Paramount, Calif.	494,4
DS-3771	Boulder Canyon, Ariz.-Calif.-Nev.	July 10	Spare thrust-bearing parts for generator units A3 and A4 at Hoover power plant (negotiated contract).	Allis-Chalmers Manufacturing Co., Denver, Colo.	14,1
100C-146	Hungry Horse, Mont.	July 3	Firefighter lookout tower and connecting road	Valley Construction Co., St. Ignatius, Mont.	34,
300C-38	Gila, Ariz.	July 8	Water supply and sprinkling system for Welton Government Camp.	Arrow Construction Co., Inc., Yuma, Ariz.	30,0
600S-96	Missouri River Basin, S. Dak.	July 15	Transformer, lightning arrestors, and Circuit breaker for Winner substation, schedules 1 and 2.	Westinghouse Electric Corp., Butte, Mont.	22,2
604C-27	Milk River, Mont.	July 7	Hay Coulee Siphon	F. L. Flynn & Co., Billings, Mont.	26,3
617C-29	Riverton, Wyo.	July 22	Closed drains	Hicks Construction Co., Riverton, Wyo.	13,
704C-256	Colorado-Big Thompson, Colo.	July 18	Construction Salida and Gunnison substations	Donovan Construction Co., St. Paul, Minn.	56,
701C-264	Missouri River Basin, Kans.	do	Earthwork and crushed rock blanket and riprap for Cedar Bluff Dam repairs.	Cass Co. Contractors, Ogallala, Nebr.	116,

Construction and Materials for Which Bids Will Be Requested by November 1952

Project	Description of work or material
W. C. Austin, Okla.	Asphaltic membrane lining for ¼ mile of Ozark Canal near Altus, Okla.
Do	Plugging 2 36-inch diameter river outlets at Altus Dam by backfilling with concrete.
Boulder Canyon, Calif.	2 motor-control switchboards suitable for controlling 440-volt induction motors for unit 8, Coachella Valley distribution system.
Cachuma, Calif.	Construction of 27- by 45-foot reinforced concrete chlorination and control house, with a 16- by 20-foot wing, and installation of plumbing, sewerage, drainage, electrical systems, and chlorination and ventilation equipment. Located 10 miles northwest of Goleta, Calif.
Central Valley, Calif.	Construction of Sly Park damsite headquarters, including warehouse, garage, office, temporary houses, water and sewer lines, and developing water supply, 15 miles east of Placerville, Calif.
Do	Construction of 43 miles of precast concrete pipe li for Saucelito irrigation district on the Friant-K Canal distribution system near Saucelito. W includes furnishing and laying 12- to 60-inch diame concrete pipe; constructing monolithic concrete m screen and pumping plant structures; installing m screens, pumping units, valves, slide and flap ga and electrical controls.
Do	Construction of 2,900 feet of 500 cubic feet per sec capacity concrete-lined Camp Creek tunnel about miles east of Camino, Calif.
Do	1 5,000-volt switchgear assembly for Nimbus pow plant.
Do	2 cabinet-type actuator governors for regulating sp of 2 9,400-horsepower propeller-type hydraulic t bines for Nimbus power plant.
Colorado-Big Thompson, Colo.	Construction of 13.8-kilovolt power and control line the foothills south area near Loveland, Colo.

Construction and Materials for Which Bids Will Be Requested by November 1952—(Continued)

Project	Description of work or material
ia Basin, Wash	Drilling 3 additional pumping wells and 2 observation wells for the Soap Lake protective works.
--------------	Drilling 2 experimental wells in the P–9 lateral area near Eltopia, Wash., and near Ringold, Wash., on the Potholes east canal.
--------------	Construction of 56 miles of 2 to 232 cubic feet per second capacity unlined laterals, sublaterals, and wasteways for laterol area P–8 on Potholes east canal, including drops, checks, turnouts, and weirs; and nine 3 to 118 cubic feet per second capacity pumping plants, near Eltopia, Wash.
i River Basin,	Construction of a 13-mile unlined reach of the second section of Franklin earth canal, near Franklin and Riverton, Nebr.
i River Basin,	Construction of Webster dam foundation, consisting of excavating and placing earthfill for cut-off trench and part of dam embankment near Webster, Kans.
i River Basin, k.	Construction of 1,340-foot long by 225-foot high Pactola earthfill dam, one 820-foot long by 115-foot high dike, and 1 1,200-foot long by 65-foot high dike. Work includes construction of spillway with concrete weir, outlet works consisting of tunnel, gate chamber for 2-foot 9-inch by 2-foot 9-inch regulating and emergency gates, access shaft, hoist house, and concrete-lined stilling basin, near Pactola, S. Dak.
--------------	Constructing foundations, steel towers, and furnishing and stringing conductor and ground wire for a 2,400-foot long crossing span and 2 800-foot anchor spans for Oahe-Midland 115-kilovolt transmission line crossing of the Missouri River.
--------------	Constructing foundations for and erecting steel towers, installing de-icing switches and transformers, and furnishing and stringing conductor and ground wire for transmission line approaches to Fort Randall switchyard and dam, near Fort Rondall, S. Dak.
--------------	Construction of 54 miles of wood-pole, H-frame, single-circuit 115,000-volt transmission line from Midland, S. Dak., to vicinity of Oahe dam site north of Pierre, S. Dak.
--------------	4 2-foot 9-inch by 2-foot 9-inch high pressure and regulating gates for Pactola Dam.
--------------	Hauling and placing riprap protection for river channel at Shadehill Dam 15 miles south of Lemmon, S. Dak.
i River Basin, k.	Clearing 480 acres of the Jamestown Reservoir site of brush, trees, and fencing, 15 miles from Jamsetown Dam.
i River Basin,	3 6,667-kilovolt-ampere, 105.9 revolutions per minute, 4,160-volt waterwheel driven generators for Little Porcupine power plant.
--------------	80- by 6-foot spillway crest gate and accessories for Missouri Diversion Dam.

Project	Description of work or material
North Platte, Wyo	Removing and replacing 80 cubic yards of concrete and 6,400 pounds of reinforcing steel in desilting works at Whelan Dam, Fort Laramie Canal, 7 miles northwest of Fort Laramie, Wyo.
Palisades, Idaho	Four 35,000-kilovolt-ampere power transfromers for Polisades power plant.
Paonla, Colo	Construction of a 2-mile, 35 cubic feet per second capacity extension to Fire Mountain Canal, northwest of Hotchkiss, Colo.
Riverton, Wyo	Furnishing and applying 30,400 gallons of asphaltic undersealing to the Wyoming Canal.
Do	Furnishing and applying asphaltic membrane lining to 41,000 square feet of certain reaches of Wyoming Canal and various places on the Wyoming laterals.
Do	Furnishing and applying asphaltic membrane lining to 84,000 square yards of surface area on Pilot Canal wasteways, Pilot Canal laterals, and Wyoming laterals.
San Diego Aqueduct, Calif.	Construction of 29 miles of 85 cubic feet per second capacity San Diego aqueduct's second pipeline from San Luis Rey River to San Vicente Reservoir. Work consists of furnishing and laying 24 miles of 48-inch and 5 miles of 54-inch inside-diameter precast-concrete pressure pipe of cylinder and noncylinder type.
Shoshone, Wyo	Construction of 2 concrete checks, involving 50 cubic yards of concrete and 3,800 pounds of reinforcing steel; and furnishing and placing 29,000 square yards of buried asphaltic membrane or bentonite lining on canal surface.
Do	Furnishing and placing 8,000 square yards of buried asphaltic membrane or bentonite lining on the laterals of the Willwood Canal, Willwood division.
Weber Basin, Utah	Construction of 3.3 miles of 9.5-foot diameter horseshoe, lined, 435 cubic feet per second capacity Gateway tunnel on the Gateway Canal near Ogden, Utah.
Yakima, Wash	Construction of 8 miles of 1,500 cubic feet per second capacity concrete-lined Chandler power canal and timber bridges from Prosser power plant to proposed site of Chandler power plant near Prosser, Wash.
Do	Furnish and install 2 6,667-kilovolt-ampere, 4,160-volt vertical generators for Chandler power plont.
Do	2 8,500-horsepower vertical-shaft, Francis-type, hydraulic turbines for Chandler power plant, and 2 2,600-horsepower vertical-shaft, Francis-type, hydraulic turbines for driving pumps at Chandler pumping plant.
Do	2 vertical-shaft, centrifugal-type pumps of 167 cubic feet per second capacity for Chandler pumping plant.
Do	2 6,100/7,625-kilovolt-ampere, 3-phase, power transformers, 1 115-kilovolt power circuit breaker, and 3 115-kilovolt air switches for Chandler power plant switchyard.

United States Department of the Interior, Oscar L. Chapman, Secretary

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The Reclamation ERA

35 Years Ago In The Era

Reviving the Art of Bread Making

Housekeepers everywhere are keenly aware that the price of the baker's loaf of bread has soared heavenward and its size has sadly dwindled during the past few months. Heads of families are wondering how they are to pay for the staff of life if it continues its upward trend. Less than 1½ pounds of bread for 10 and 15 cents does seem exorbitant even with flour at $7.50 a hundred.

In one of the large coast cities a campaign is under way to induce the housekeepers to make their own bread, and would you believe it, there seem to be as many of them ignorant of the process as there were grown women who had forgotten the art of knitting socks and wristlets when the war began three years ago.

(From an item by Edith C. Salisbury, on page 453 of the October 1917 issue of the RECLAMATION RECORD, predecessor to the RECLAMATION ERA).

OUR FRONT COVER. Although less than a handful of fluff, this 2-day-old Mongolian pheasant chick is playing one of the leading roles in the wildlife conservation program on the North Unit of the Deschutes project in Oregon. Photo by Stan Rasmussen, Region 1 photographer.

OUR BACK COVER is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners Kittredge and Coolidge.

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R. F. Sadler, Editor

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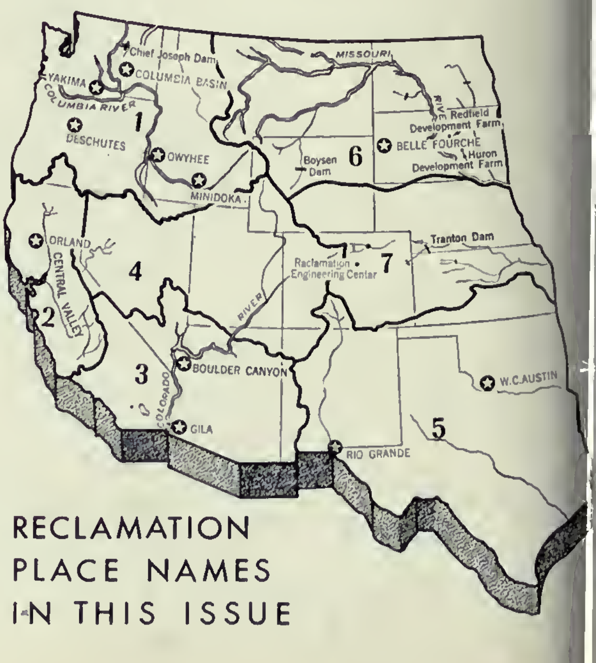
In this issue . . .



RECLAMATION PLACE NAMES IN THIS ISSUE

"FREE AS A BIRD"—Laverne Brugger, student of Oregon State College, who works with the State Wildlife Research Unit, releases a Mongolian pheasant—one of the thousands of birds liberated on the North Unit in a bird management program made possible through Reclamation development in that area. *Photo by Stan Rasmussen, Region 1.*

by DICK LARSEN
Region 1 Headquarters, Boise, Idaho

LIBERATED DP'S (Deschutes Pheasants)

ARDENT HUNTERS, FARMERS, fish and game agen-, and the Bureau of Reclamation are creating aluable by-product of irrigation through a asant "planting" program on the North Unit he Deschutes project in central Oregon.

Vhen the Bureau began delivery of water to the 00-acre North Unit in 1946, the Oregon Cooptive Wildlife Research Unit of the Oregon te Game Commission, and other agencies, nched a program aimed at insuring the future dlife of the region.

'hey saw that irrigation of the North Unit ds was going to provide an excellent habitat for tain upland game birds. But irrigation of rth Unit lands—very near the heavily popued Willamette Valley—was also expected to stir a real problem or two. The agencies foresaw usands of hunters being drawn from Portland l other population centers to this new pheasant adise, perhaps wiping out the new bird popuon with a few seasonal bombardments. Aner problem was foreseen for the region in the tion that occasionally arises between the overhusiastic hunter and the home-loving farmer.

'o avoid these problems a program of game nagement was mapped out right along with the nning for the reclamation project in what is believed to be the first time in the United States that such planning activities have been carried out simultaneously.

In 1946, as the Bureau of Reclamation brought more and more acres under irrigation, the Game Commission's wildlife program and research work moved forward. The area was restricted to hunters, and a pheasant-stocking and inventory program was put into effect. The game management program on the North Unit naturally did not sail onward without its customary quota of crises. At first some opposition cropped up among persons who felt that such a program on their land was entirely impractical. Later, by interviewing the individual land holders it was found that 85 percent were actually interested in the program that was being planned. Another crisis came along when the sportsmen took a dim view of closing the waterfowl season in 1950. When informed during an open meeting that the closure was necessary to determine what was becoming of the introduced game in winter months, the sportsmen promptly began drawing up a resolution offering further protection to the pheasants.

By last year, 4,600 ring-necked pheasants had been planted on the North Unit. Approximately 2,200 were liberated in 1948, followed by a release

BANDED FOR IDENTIFICATION—An Oregon State Wildlife Re search Unit worker clips an identification marker on a Mongoliar pheasant at left. Above, some of the 2-week-old Mongoliar pheasant chicks released in the North Unit wildlife program *Photos by Stan Rasmussen.*

of 1,400 in 1949 and 1,000 in 1950. Inventories have been taken periodically and the population has been rising steadily. At the beginning of this year the population was about 8 birds per 100 habitat acres. When the population reaches a level of between 20 and 25 per hundred habitat acres the hunters will enjoy their first harvest. Increase in pheasant population must depend largely on natural reproduction. The Oregon Cooperative Wildlife Research Unit states that diversified crops in irrigated acres offer excellent cover and become ideal habitats for pheasants in the first 10 years of development.

In addition to pheasant, Valley Quail and Hungarian Patridges are expected to further enhance the wildlife value of the North Unit. Although the establishing of Valley Quail is a precarious job, the prospects for this bird settling and thriving on the North Unit appear favorable. The Hungarian Partridge, another excellent game bird (although something of a transient) is also expected to find the North Unit to his liking.

Although migratory waterfowl must move on when severe winter weather takes an icy grip on the area, their importance in the field of sport is not being overlooked. Through agreement with the interrelated agencies and the farmers, wasteway water is being used to make attractive resting and feeding impoundments.

Before an open season on any of the birds i declared, a thorough analysis of the conditio under which hunting may be permitted will b prepared and considered carefully in this uniqu game management program.

The Oregon Game Commission has demon strated its appreciation for the significance of thi operation by regarding it as a model to follow i future similar situations—a model experimen following the lines of real conservation so that th greatest good to the greatest number will be th final result.

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Good Hunting in the 17 Western States

According to a recent announcement by Secre tary of the Interior Oscar L. Chapman, 10 extr shooting days have been added to the 1952 huntin season for migratory waterfowl and coot. He is a tabulation for the 17 reclamation States. F additional information consult your State fish an game department.

State	From—	To
Arizona	Oct. 24	Jan. 1
California	Oct. 24	Jan. 1
Colorado	Oct. 20	Dec. 1
Idaho	Oct. 11	Dec. 1
Kansas	Oct. 12	Dec. 1
Montana	Oct. 10	Dec. 8
Nebraska	Oct. 11	Dec. 9
Nevada	Oct. 17	Dec. 25
New Mexico	Oct. 14	Nov. 6
	Dec. 18	Jan. 10
North Dakota	Oct. 1	Nov. 2
Oklahoma	Oct. 18	Dec. 16
Oregon	Oct. 24	Jan. 1
South Dakota	Oct. 3	Dec. 1
Texas	Oct. 31	Dec. 2
Utah	Oct. 17	Dec. 25
Washington	Oct. 17	Dec. 2
Wyoming	Oct. 17	Dec. 1

GOOD SEED PROGRAM *helps to guarantee yield and income. ove, cutting a seed crop on the Yuma Mesa Division of the Gila project in Arizona. Photo by Samuel B. Watkins, Region 3 photographer.*

IMPROVING ALFALFA SEED IN ARIZONA

All of the experiment stations in the impor-nt seed producing and consuming areas in the nited States and Canada are cooperating in a tion-wide plan to test and improve hardy alfalfa ed.

When the Board of Directors of the Arizona rop Improvement Association, a voluntary, pri-ate organization, heard that the Yuma Experi-ent Farm did not have sufficient funds available r participating in this plan by developing isola-on plots for alfalfa seed production, they voted a ant of $2,200 to the Arizona Agricultural Ex-eriment Station to help in this work.

As a result of the Association's coperation, dur-g the next 7 years, seed produced in Arizona der this plan will be tested along with compar-ble northern-grown seed for winter hardiness, rought and wilt resistance.

The production of seed of hardy disease resist-nt alfalfa varieties in Arizona and California for se in northern, eastern, and central western States has become an important agricultural industry particularly on certain Reclamation projects. Homesteaders on the Yuma Mesa Division of the Gila project, in Arizona, devote considerable acre-age to growing alfalfa seed of the Ranger, Buffalo, and Atlantic varieties. It is expected that large acreages on the Wellton-Mohawk Division of the Gila project likewise will be devoted to the pro-duction of hardy alfalfa seed which many of the present farmers in the area now are growing. In Arizona the seed of these hardy alfalfas is pro-duced and marketed under the close supervision of the Arizona Crop Improvement Association which, by its recent action, has demonstrated its keen interest in improving Arizona's alfalfa seed and sales.

According to H. E. Jacka, Secretary-Treasurer of the Arizona Crop Improvement Association, it is most important that Arizona cooperate in this program in the interests of future markets for its alfalfa seed.

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221768—52——2

FARMERS AND BUSINESSMEN listen to land use assistant John W. Eckerdt as he explains how corn is irrigated. The group is one of several touring South Dakota's Huron and Redfield developmen[t] farms last July.

TOURING SOUTH DAKOTA'S OASES

by JACK BAILEY
Missouri–Oahe District, Huron, S. Dak., Region 6

South Dakota State College played host to 300 men and women last summer during a tour of the Huron and Redfield irrigation development farms in the James Valley of South Dakota.

The college is conducting research projects on the two farms, part of the Oahe Unit, James Division, of the Missouri River Basin project. Under a cooperative agreement with the Bureau of Reclamation, specialists test soil and water relationships and irrigation practices. Their objective is to produce the best seed types and pasture crops for the area.

Tours are conducted regularly to demonstrate to businessmen and farmers what is possible under irrigation in this eastern periphery of Reclamation territory. The Huron farm has been in production 6 years, and the Redfield, 5 years. More than 30,000 persons have visited the farms since their establishment.

This summer, on July 11, 1952, the 300 "tourists" tramped the length and breadth of the farms, and talked to the State College specialists in horticulture, agronomy, animal husbandry, and irriga[-] tion who were stationed at strategic spots through[-] out the farms to explain the various research tests.

The State College group was headed by Dea[n] A. M. Eberle of the College of Agriculture; Dr. I. B. Johnson, Director of the Experiment Statio[n] and Dr. W. W. Worzella, Head of the Agronomy Department. Among Bureau of Reclamation per[-] sonnel on hand for the tour were E. D. Eaton o[f] Washington, D. C., Director of Operation an[d] Maintenance; W. E. Rawlings, Assistant Regiona[l] Director of Region 6 and E. F. Landerholm, Re[-] gion 6 Operation and Maintenance Superviso[r] both of Billings, Mont., and J. W. Grimes, o[f] Huron, S. Dak., District Manager of the Missouri[-] Oahe District. Dr. Johnson and Mr. Grimes ga[ve] short introductory talks as the tours began a[t] each farm.

Earlier in the year, a partial drought threatene[d] South Dakota following the Missouri River floo[d]. Warm, drying winds, reminiscent of the "thirties" blew most every day in April and May. Fields o[f] ain stopped growing at knee height. Meadows native hay had thin stands, and ranges started rning brown. During this period, the oasis-e greenery of the two development farms stood striking contrast to the crop-stunted landscape north central South Dakota. The rains came

ERE'S A LOT OF COLE SLAW the 30 tons of cabbage per re, grown on the Redfield rm, exhibited by Dr. Sol Cook the Horticulture Department, uth Dakota State College.

June in time to save the corn, but by that time e small grain and hay crops had been reduced to 60 percent in almost two-thirds of the State. rompted by the well-known fear of recurring ought, the people on the tour were impressed by:

1. The first cutting of irrigated alfalfa which n 4.5 tons per acre.
2. Ten acres of mixed legume and tame grass sture plots which remained belly high after eding 24 head of cattle for the summer and addg from 300 to 400 pounds to the weight of each.
3. Cabbage which ran 30 tons to the acre on the edfield irrigated truck plots.
4. Corn more than shoulder high to a 6-foot man contrast to waist-high corn on adjacent dry land.
5. Potato and tomato fields which promise to uplicate the 1951 performance, when irrigated omatoes yielded 15 tons per acre and potatoes 536 ushels per acre.

During the course of the tour, many of the ourists" commented favorably on irrigation, ost of them favoring the idea of combining liveock with irrigation. Many farmers in places reote from the James Valley revealed that they are ing small-scale irrigation from wells, and many ore displayed an interest in doing so. Water or the Bureau's two development farms is pumped rom the nearby James River and run by gravity the fields. The Redfield farm has about 140 rigated acres; the Huron farm, 100. The former s devoted to grain and truck, while the Huron farm is used chiefly for research in hay and forage production for livestock.

The farms are units in the general investigations involving the 750,000-acre Oahe Unit approved by Congress in the Flood Control Act of 1944. The irrigation investigations were inaugurated in 1947 along with the establishment of the Missouri-Oahe District office in Huron, S. Dak. ###

Chief Joseph to Aid Irrigation

Power revenues from the Army-constructed Chief Joseph Dam and power plant on the Columbia River in north central Washington may be used to help pay for irrigation development of 65,000 acres of family-sized farms, as provided for in Public Law 577, signed by President Truman on July 17.

The farm units, to be located in Okanogan, Douglas and Chelan counties, would be established as an additional water resource conservation feature of the Chief Joseph project, at present a single-purpose hydroelectric power undertaking 51 miles downstream from the Bureau of Reclamation's Grand Coulee Dam. The Army Engineers started constructing Chief Joseph Dam in 1949. It is scheduled for completion in 1955. Bureau of Reclamation technicians are now speeding up the necessary investigations leading up to a study and report to Congress, upon which depends the authorization for construction of the Chief Joseph irrigation works. •

221768—52——3

THE COMPLETION OF THE GIANT TRENTON DAM on the unruly Republican River in southwestern Nebraska will mark another era well underway in an area that has seen the beginning and ending of many eras by events that were spectacular and sometimes fast moving and disatrous. The "short grass" plains area is the area of the "last frontier" of the old West. It is the area of the buffalo and Indians, sod huts and prairie fires; the area of dust storms and droughts, intense rainstorms, tornados and floods; an area where nature ruggedly romps through extremes.

Trenton Dam, a part of the Frenchman-Cambridge Division of the Missouri River Basin project, is an 8,000,000 cubic yard earthfill structure 144 feet high and 9,000 feet long. It will form the

TRENTON DAM: ANOTHER ERA

by ELLIS L. ARMSTRONG, Construction Engineer
Trenton Dam, Trenton, Nebraska

multiple-purpose Swanson Lake which has a total capacity of 365,000 acre-feet of storage of which 123,000 is for sediment retention and irrigation storage and the remainder is for flood control. Its function is to place a harness on the unstable Republican River to keep it in control and to supply water to fertile lands to increase production of foods and to insure that production every year.

The Republican River in the past has not contributed as it should to the welfare of the valley. When water was needed, too often the river has been bone dry, and when it wasn't needed, many times it has been a muddy, rampaging torrent which literally gallops down the valley carrying precious topsoil, trees, farm buildings, and even livestock and people with it on its destructive course. The river at Trenton Dam has varied in flow from nothing to 200,000 cubic feet per second.

The uncertainties of nature and the abuse of the soil, culminating in the dust bowl days of the thirties and the disastrous flood of 1935, which drowned 135 folks of the Republican River Valley, have resulted in the area losing nearly 30 percent of its people in the last 20 years. The catastrophic 1935 flood undoubtedly marked the end of an era and the beginning of a new. It then became clear that, if the Republican Valley were to retain her people and progress, the river must be controlled and put to use. The dust bowl days emphasized the need for soil conservation. It is a common statement of the valley people concerning the thirties that "Everything not washed away by the floods was blown away by the dust storms."

Today, good soil conservation practices are the rule in the valley and, with the completion of Trenton Dam, the river will be controlled and the waters made available for irrigation. This dam with Medicine Creek, Enders and Bonny, previously completed, and the planned and completed diversion dams and canals, makes the new era a reality. Stability will be had, opportunity for the young people will be available so that they will not need to go elsewhere. The area now promises much for the years ahead.

The "Woodland" people had an era in the area about 1,000 years ago. Excavations in the project construction area under supervision of Dr. M. F. Kivett of the Nebraska Historical Society have unearthed several village sites. One of the old villages was located in the borrow area for the dam and one on a hillside at Massacre Canyon through which the relocated railroad passes. The people lived, flourished, and disappeared. It is believed they lived principally on game and wild plants but it is possible they may have cultivated crops. Their disappearance can probably be attributed to prolonged drought as their remains are covered th a layer of sterile dust from a few inches to a ot or more in thickness on top of which the escnt humus soil and grass cover has developed. The "Upper Republican" people followed and ere in the area about 1350 to 1500 A. D. Indica-ons of their culture were found in the Trenton am area. It is believed that their culture was of more permanent type than the Woodland people d that they cultivated corn, beans, and squash.

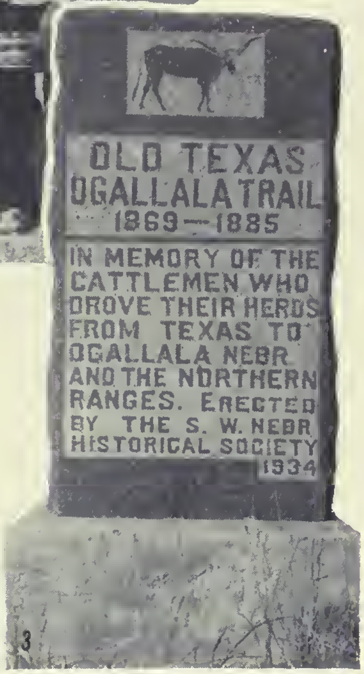
ORE THE FOURTH—THE ERA OF IRRIGATION—came the era prehistoric man, of the Pawnees and Siaux, and of the cattlemen. left, J. J. Cram's aerial photo of the area. (1) "Woodlands" ian of 1,000 years ago, Nebraska Historical Society photo by M. F. Kivett. (2) Sioux Indians at Massacre Canyon Monu-nt, photographed by Russell I. Alley, Bureau of Reclamation. Monument to "the cattlemen who drove their herds fram Texas Ogallala, Nebr., and the Northern Ranges." (4) M. L. Willson's wing of Trenton Dam as it will look when completed.

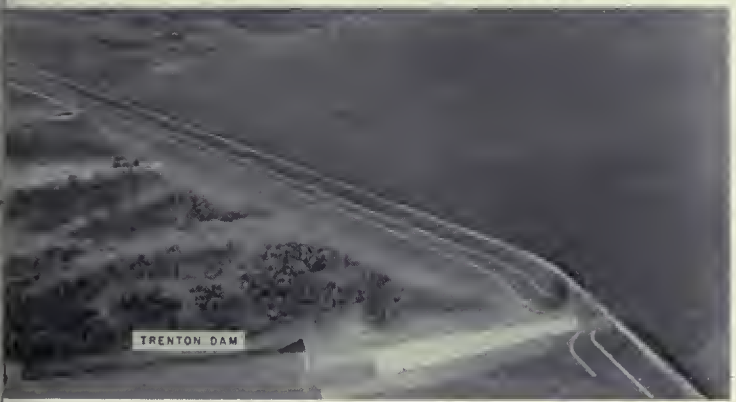
It appears they suffered the same fate as did the Woodland people and were forced out of the area by drought.

Indications were found at the dam abutments and at Massacre Canyon of Pawnee villages dated about 200 years ago. This was probably the beginning of the era that culminated in the massacre of the Pawnee Indian Nation by the Sioux in 1873 at this canyon which has been so aptly named.

The Pawnee Indians claimed this area as their own. After the advent of the white man and the confinement of the Indians to reservation areas, this area was assigned as hunting ground for the Pawnees. However, the Dakota branch of the Sioux nation also felt it was their hunting ground, and although they were supposed to stay north of

THE UPPER REPUBLICAN VALLEY





200 YEARS OF WATER RESOURCES ENGINEERING EXPERIENCE is represented in this group of "elder statesmen" which met at Cody, Wyo., during the week of July 17 to help formulate the Bureau's construction and operational program for the year. Seated, l. to r., Harry W. Bashore, former Commissioner of Reclamation (40 years service); present Commissioner Michael W. Straus (18 years); Frank A. Banks, builder of Grand Coulee Dam (44 years); standing, Walker R. Young, former Reclamation Chief Engineer (37 years); R. J. Newell, former Region 1 director (26 years), and H. D. Comstock, former Region 6 director (42 years).

Missouri Basin Power Line in Iowa

Reclamation Commissioner Michael W. Straus recently announced a contract award for constructing footings and erecting towers for a 230-kilovolt transmission line to carry Missouri Basin Power from Fort Randall Dam to Sioux City, Iowa. Lipsett Inc. of New York, N. Y., was the successful bidder, and the American Bridge Co. will supply the steel. The contract for furnishing and stringing conductors is still to be awarded.

The line is to be completed soon after initial production of power at Fort Randall, scheduled for August 1954. Ultimately, it will serve parts of Nebraska, Iowa, Minnesota, and South Dakota.

Fort Randall, Oahe, and Garrison Dams and power plants are all under construction by the Corps of Engineers as part of the Missouri River Basin program. All power from these plants will be marketed by the Bureau of Reclamation. •

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the Platte River, they cast covetous eyes at the rich hunting area of the Republican Valley which from 1860 to 1873 was perhaps the greatest hunting ground in America. "Doc" Carver, the great frontiersman and marksman, hunted the area and claimed that in 1870 within a 25 mile stretch of the valley he saw "at least 500,000 buffalo."

In August 1873, the Pawnees staged their annual buffalo hunt in the Republican Valley. The hunting party consisted of over a thousand horses, 600 young men of the tribe, and enough women and children to tend to the work of skinning and dressing the animals which were killed. On the fifth day of August they reached Massacre Canyon, 4 miles east of Trenton Damsite. They were engaged in killing buffalo when attacked through the buffalo herd by 1,200 Sioux warriors. In the battle that followed the Pawnees were nearly annihilated. They were saved from complete slaughter by the arrival of United States Cavalry troops, who had been dispatched to the area because of reports of impending trouble.

This battle ended the fabulous hunting era as within 2 years the remainder of the Pawnees had migrated to Oklahoma, the Sioux were subdued and maintained in their reservation, and the buffalo disappeared because of the greed of white hunters.

The monument commemorating the last Indian battle in America, marking the ending of an era, is located on a hill where excavation, connected with the starting of another era, unearthed the story of other people of 1,000 years ago.

The old "Texas Trail" from South Texas to the Union Pacific Railroad at Ogallala, 80 miles north of Trenton, passed across the valley just 1 mile east of Trenton Dam. In 1879 a herd of 55,000 head of cattle was driven over the trail and it is estimated that between two and three million cattle passed across the valley on the 1,500-mile Texas Trail jaunt to Ogallala.

However the open range cattle era was cut short by the construction of the C. B. & Q. Railroad up the valley in 1882 and the arrival of settlers, plows and barbed wire and the establishment of homes in sod huts. One of the last big roundups was held in 1881 at the present site of Trenton and one rancher had over 10,000 cattle. A severe winter in 1885–86 killed off most of the remaining large herds of cattle and ended the Texas long-horn cattle era.

The pioneer settlers' era was marked by crop failures, by drought, loss of stock by severe cold and snow in the winters, and by floods. Irrigation was practiced as early as 1886 when a group of settlers built a diversion from the Republican River 3 miles west of Trenton Dam. The project was abandoned after 2 years because, when the water was needed, the river was dry. Wheat was introduced in the area about 1890 and since has been the principal crop. The irrigated areas of the new era will provide needed diversity and stability to the agricultural economy. ###

National Employ the Physically Handicapped Week is designated this year by the President of the United States as October 5–11. Since 1945, this observance has focused attention on the year-round program in behalf of rehabilitating and employing persons who have certain physical imperfections, but who are ready, willing and able to perform well a multitude of tasks.

The American Medical Association's Council on Industrial Health said recently, "The employability of the handicapped depends on the emphasis placed on the individual's ability rather than the disability . . . As a matter of fact, few adults are physically perfect. Minor defects present no problem, and suitable placement solves most of the others."

Last year the Reclamation Era, *at the request of Vice Admiral Ross T McIntyre (MC), USN, Retired, Chairman of the President's Committee on National Employ the Physically Handicapped Week, cooperated by publishing the article, "America Needs All of Us" in the October 1951 issue. Here is this year's story of people in the Reclamation area who prove the wisdom of, as Admiral McIntyre says, "Respecting the God-given dignity of each individual" and providing equality of job opportunity for handicapped workers.*

Ready, Willing and Able

Earl D. Newton isn't a large man. In fact, he's almost frail, weighing less than 170 pounds and standing 5 feet, 9 inches. And although he'll mark his 62d birthday in December, Newt, as he is called, often can be seen in the Bureau of Reclamation laboratories crushing concrete cylinders up to 6 feet high and 3 feet in diameter; or, literally, pulling apart forged steel bars measuring up to 6 inches in diameter. And all of this in spite of the fact that his right foot was removed as a result of infection that followed a sprained ankle suffered when he was 7 years old. He has help, of course, in the form of "Mr. Muscles," a three-story-high machine known as a universal testing machine, but one whose operation calls for a steady hand, the ability to read sensitive gages and make careful computations from collected data.

Newt has never held a "white collar" or desk job. The closest he has come to sitting-down-work was as a chauffeur, which involved the maintenance of cars and trucks in addition to merely driving them.

NEVER MISSES A DAY'S WORK.—Earl D. Newton at the control panel of the five-million-pound capacity universal testing machine in Denver's Reclamation Engineering Center. *Photo by Charles Knell, Region 6 photographer.*

Before joining Reclamation 18 years ago this month (October), Newt had done general garage work in Portland, Oreg., driven trucks and worked in warehouses, been a sheet metal worker in an automobile body factory, and mined gold, quartz, and coal in Colorado—jobs many nonhandicapped persons might consider too rugged.

Newt went to work in Reclamation's Engineering Laboratories in 1934. He was first classified as a laborer, and assigned to tasks like crushing aggregate to be used in testing. His former experience and skill soon called for his redesignation as mechanic in the laboratories.

In 1939, Newt's supervisors requested for him a permanent civil service appointment. On the basis of a cold, impersonal medical report, the commission at first denied the application. However, upon reexamination of Newt's case, requested by the then Bureau Chief Engineer, R. F. Walter, the commission realized that a missing right foot affected his ability no more than a missing fingernail.

For 5 years he had not only been performing capably and satisfactorily, but during that 5 years he had not missed even a fraction of a workday because of illness.

Earl became an assistant engineering aid in the Bureau laboratories in 1937, a laboratory aid in 1943, and in 1945 an engineering aid. It is in this latter capacity that Newt can be seen performing his Samson-like feats with concrete and steel.

Newt also acts as foreman of the labs' "elasticity" crew which conducts tests on a wide variety of concrete, rubber, fabric, and many other construction materials.

Even during school days Earl Newton refused to allow his handicap to interfere with his activities. He played baseball and basketball on high-school teams, and was a member of the first team on the basketball squad.

As is so often true in these cases, it is not accurate to refer to Newt as handicapped. To the casual observer, his disability is not apparent. He walks with a trace of a limp, he performs his job dependably, accurately, and quickly. To see him poised on an upper tier of the giant universal testing machine, securing a test specimen to the machine's cross arm, one would think that he possessed special aptitude for scurrying about in precarious spots.

Earl Newton's case proves again that ability counts.

On the Columbia Basin project in the State of Washington, 108 Bureau of Reclamation employees are disabled veterans, representing approximately seven percent of the district personnel.

In addition, there are men and women who are nonveterans who are handicapped and doing a full-time job of helping to make this project successful.

Some are among the operating personnel employed to keep the irrigation canals flowing with water now that irrigation water has been made available for the first 66,000 acres of the ultimate 1,029,000 acres in this central Washington area.

Herman Bertram, who is stationed at the Moses Lake Watermaster headquarters, is among these. Bertram was hired April 28, 1952, as the start of irrigation neared. He is recovered from a spastic paralysis that affected him in his younger years, and he is able to handle a maintenance labor role.

Settlers on this project, in some cases, carry their scars from World War II. Among these is William S. Lovercheck, a former paratrooper, who continues to make a successful life on the Pasco Unit, despite serious wartime injuries. His picture appeared on page 234 of the October 1951 issue of the Reclamation Era.

In the Finance Division of the Columbia River District headquarters at Ephrata, Wash., is George Komoto. He lost a leg while serving in the Japanese-American regiment which fought in Italy. Now, a government accountant, he is head of the allotment unit which sees that the various offices don't overspend their appropriations.

In the same division is Russell W. Chambers, accounting clerk, who suffers from arthritis. His handicap does not interfere with his job of processing important papers dealing with selling, renting and leasing government property.

At Ephrata also is Orville Long, government accountant. At the age of 12 he suffered a bone infection which resulted in complete ankylosis of the right hip joint. This handicap did not prevent him from purchasing a 1-acre part-time farm unit near Soap Lake, nor from being listed in the 1951 edition of Who's Who on the Pacific Coast.

In the 17 western States where the Bureau of Reclamation operates, in the laboratory, on construction jobs, in the offices, along the ditches and reservoirs, and on the farms, those with physical handicaps are ready, willing and able to tackle the job of harnessing America's resources and bringing forth the wealth of the land. ###

DO YOU IRRIGATE IN THE FALL?

FOR NEXT YEAR'S CLOVER—*September irrigation on Keith H. Johnson's Hunt Unit farm on the Minidoka project in Idaho. Photo by Phil Merritt, Region 1 photographer.*

If you live in an area where a dry, open winter is more of a rule than an exception, where there is little or no water held over in reservoirs, and winter moisture is normally short, "putting the crops to bed with their feet wet" is good insurance.

In such circumstances, irrigate alfalfa, clover and pasture grasses during the fall to supply water during the winter and build up reserves for the spring. But woody plants such as shrubs, berries and trees need a dry period in which to harden up before cold weather begins. Put them to bed for the winter after the leaves have fallen but before the first frost.

Fallow or open fields can carry water over for next year's crops, but as a rule they should not be wet any deeper than 6 to 8 feet. Any more penetration wastes water and leaches out plant foods. Be careful irrigating fallowed fields as waste water can cut gullies and fill roadside ditches with valuable soil.

Once the soil has frozen, there is not much use in trying to irrigate—but your perennial crops and next year's crops will do much better next year if the soil is kept moist, whether by fall irrigation or the rains and snows. (Adapted from the Business Farmer, Scottsbluff, Nebr., October 1951 issue, with the kind permission of the Editor, Jim Numon).

Funds for Boysen Lands Transferred to Indians

Congress recently passed Senate Bill 3333 enabling the Bureau of Reclamation to transfer $458,000 to the credit of the Shoshone and Arapaho Indian tribes to compensate for some of their lands taken over for the construction of Boysen Dam and Reservoir on the Big Horn River in Wyoming.

The settlement amount was agreed upon by the General Council of the Shoshone and Arapaho Indian tribes in July 1950. The agreement was confirmed by a memorandum of understanding between the Commissioners of Indian Affairs and Reclamation. It provides for title to the 25,880 acres of land to be transferred to the United States but permits the Indians to retain access to a part of the Boysen Reservoir shoreline and grazing rights to some of the reservoir area when not inundated. •

The Downstream Dynamics of Hungry Horse

High in the mountains of Montana, on the upper reaches of the Columbia River, a new power plant named Hungry Horse goes into production this month.

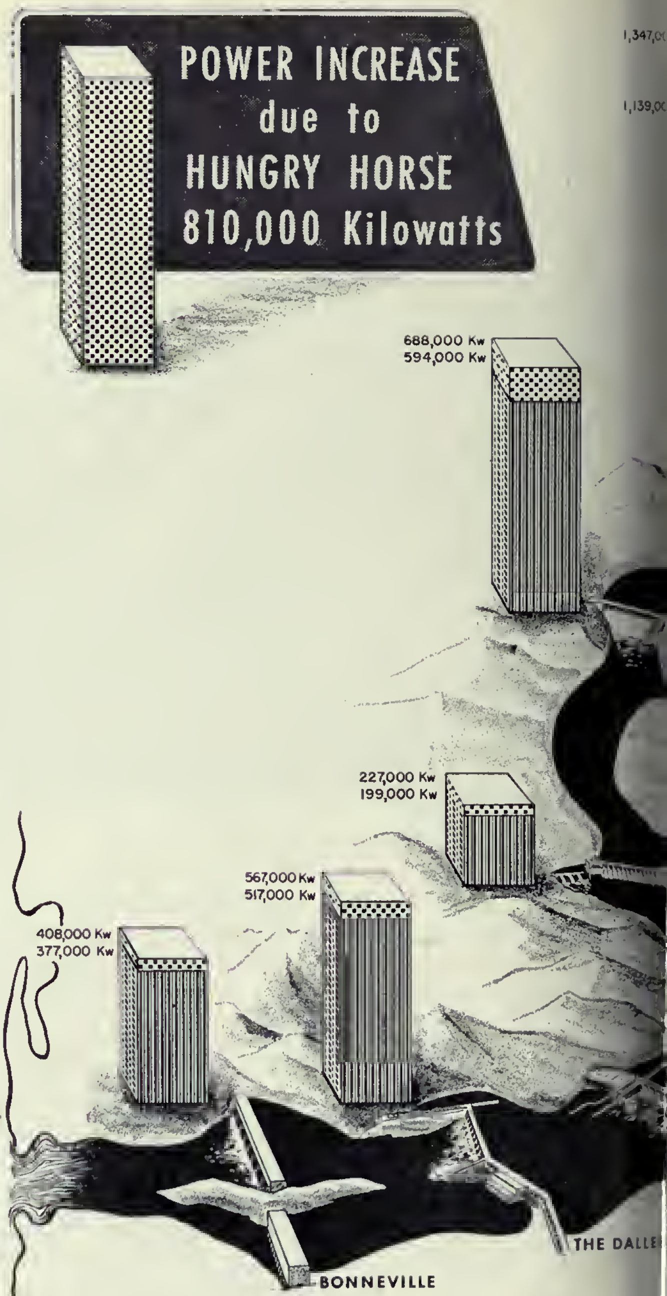
Down along the river, private and public power plants are beginning to flex their muscles to take care of the additional firm power—613,000 kilowatts—which they will be able to produce because Hungry Horse was built.

And this is "firm" power only, the number of kilowatts which can be produced 365 days a year, even during the driest series of years anticipated. During years of high runoff and storage in Hungry Horse's 3½ million acre-foot reservoir, maximum production will be even higher. For example, the accompanying illustration attributes 197,000 kilowatts of firm power to Hungry Horse, whereas its actual installed capacity is 285,000 kw.

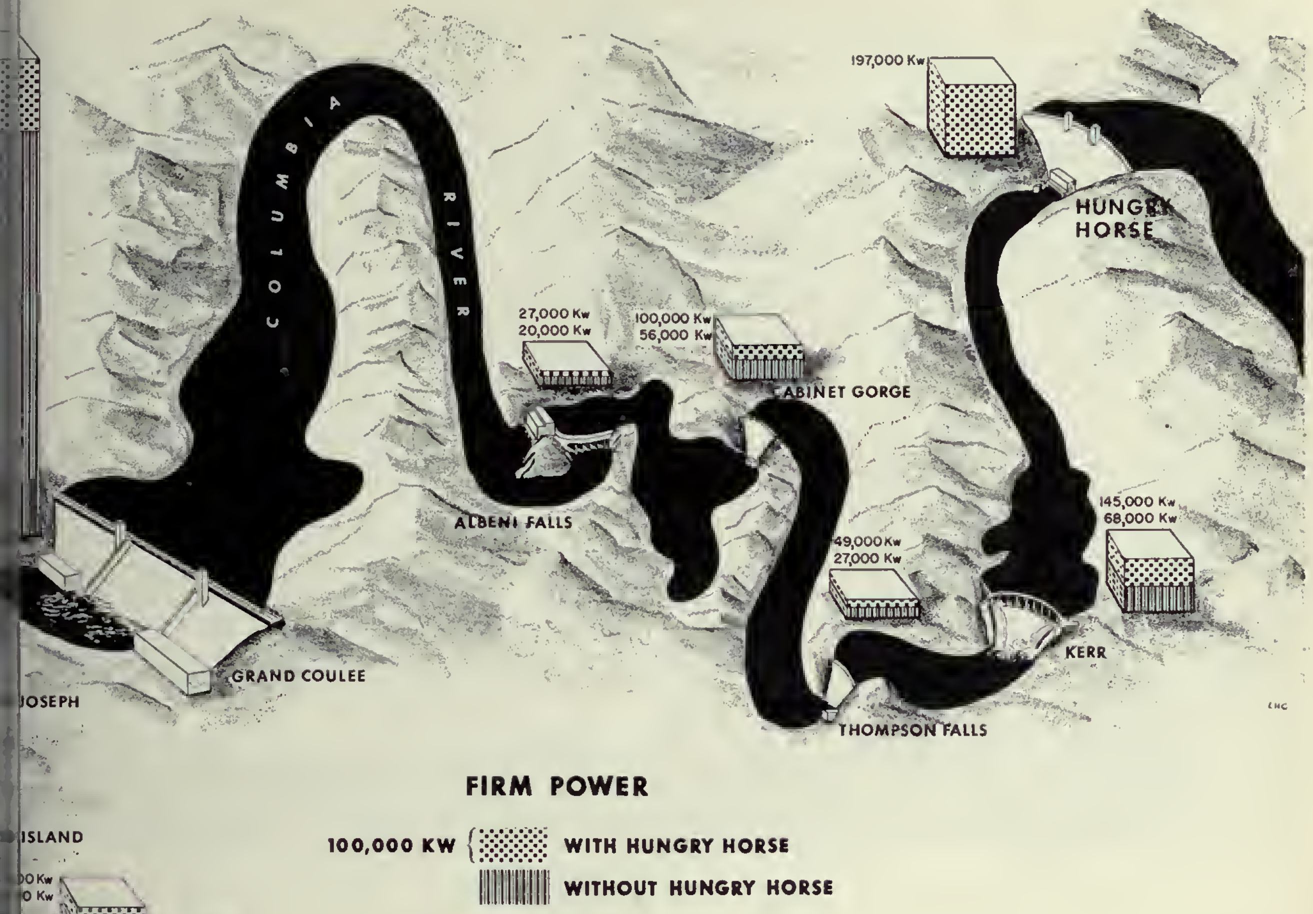
As the power of the Columbia River tumbles from one plant to another, under a controlled system of releases, the operators of each plant, knowing that there will be a dependable amount of water to convert into electricity, can run their plants at least up to the "firm" power rating—winter and summer, drought or flood. As runoff increases, the output of energy can be stepped up.

Not counting its own installed capacity, the added power made available by Hungry Horse is over 3 times its firm production when all four of its 71,250-kilowatt generators are installed. Grand Coulee alone will be able to produce 208,000 additional kilowatts as a result of Hungry Horse's strategic location in the upper reaches of the Columbia—11,000 more kilowatts than the firm generation at Hungry Horse itself.

This additional hydroelectric power will benefit water users in the Pacific Northwest through the availability of low-cost power for farm and home use and for pumping irrigation water. If, and when, the irrigation possibilities in the Flathead Valley are developed, excess revenues from the sale of Hungry Horse power can be used to help the farmers repay the Federal Government for bringing water to the proposed 60,000 acres near the city of Kalispell.



PLANT	STATUS
Bonneville	Constructed and operated by the Corps of Engineers.
The Dalles	Construction started last year by Corps of Engineers.
McNary	Construction to be completed by Corps of Engineers in about 2 years.
Rock Island	Owned and operated by Puget Sound Power and Light Company. Now being enlarged to take advantage of Hungry Horse's upstream benefits.



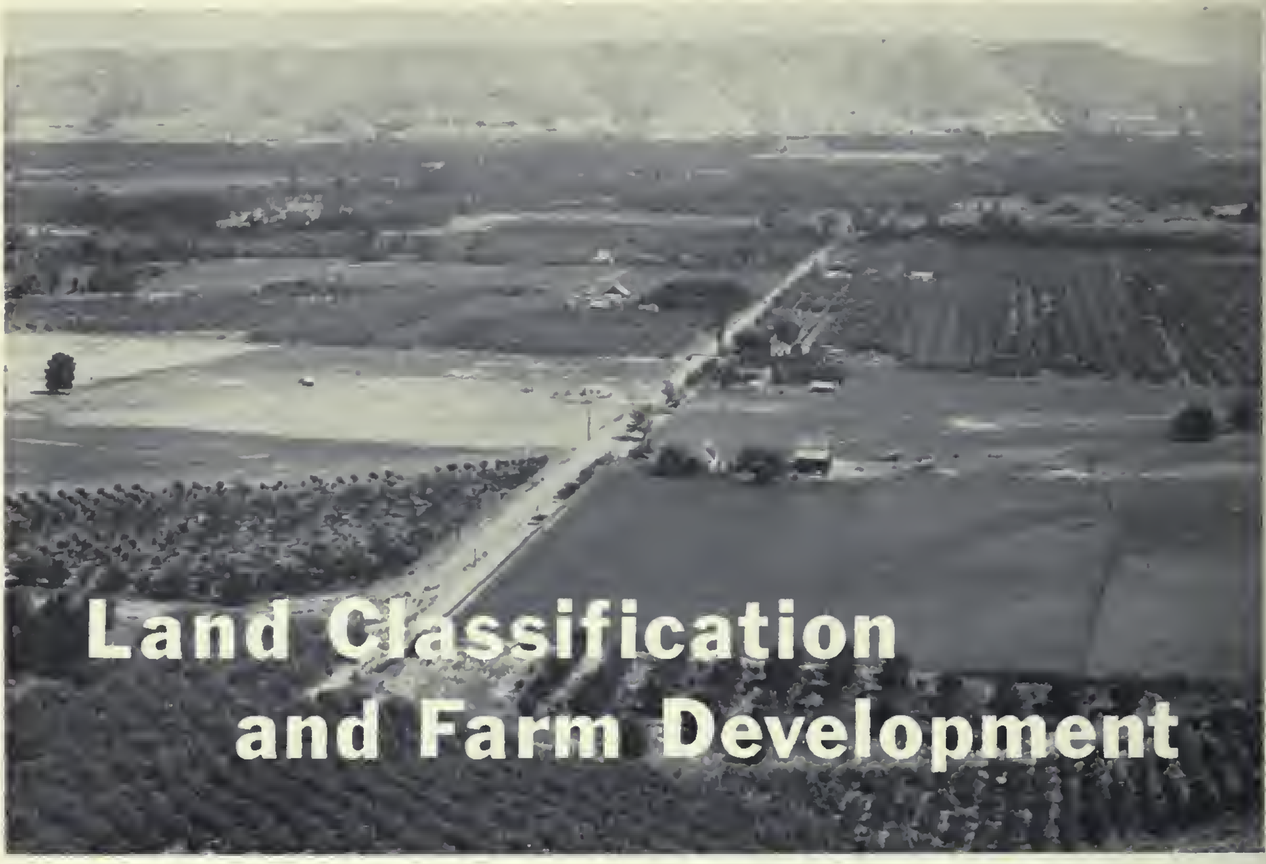
HOW HUNGRY HORSE SETS POWER-FULL PACE

Year-round dependable power supply made possible through coordinated system operation

PLANT	STATUS
Chief Joseph	Under construction by Corps of Engineers, about ⅓ completed.
Grand Coulee	Constructed and operated by Bureau of Reclamation. Power marketed by Bonneville Power Administration.
Albeni Falls	Under construction by Corps of Engineers; to be completed within two years.
Cabinet Gorge	Under construction by Washington Water Power Company. To be completed in about a year.

PLANT	STATUS
Thompson Falls	Completed. Owned and operated by Montana Power Co.
Kerr	Completed. Owned and operated by Montana Power Co.
Hungry Horse	First power on the line this month. Built and operated by Bureau of Reclamation. Power marketed by Bonneville Power Administration.

In addition, proposed dams and power plants that would derive power benefits from Hungry Horse are: John Day, Ringold or Richland, Priest Rapids, Rocky Reach, Wells, Boundary, Noxon Rapids, Trout Creek, and Paradise.



Land Classification and Farm Development

by E. N. POULSON, Soil Scientist, and
L. R. SWARNER, Irrigation Engineer,
Boise, Idaho

SUCCESSFUL IRRIGATION FARMS depend upon proper planning, before, during and after construction of the project works. Above, the fertile farms in the Natches Valley, Yakima project, State of Washington. *Photo by Stan Rasmussen, Region 1 photographer.*

Part 9 in a series of articles on soils and land classification

THE SUCCESS OF ANY RECLAMATION PROJECT, in the final analysis, depends upon the settlers. They prosper if they are able to meet operation and maintenance charges, repay their share of construction costs, make enough profit to represent a reasonable return on their investment, and maintain a good standard of living.

To provide these conditions, it is essential to plan the proper size and type of farm units. Land classification is important in this determination. On the million-acre Columbia Basin project, in the State of Washington, detailed studies have been made to determine the acreage of various classes of land or combinations of classes necessary to support an average-sized family at a suitable level of living. The crops which can be safely grown, the probable yields under average management, and the long time average financial returns which may be expected per acre differ markedly between various classes of land. The land classification for the project area provides an ideal base for the establishment of the farm type and size as well as the location of the farm unit boundaries.

On the Roza Division of the Yakima project in the State of Washington, where public land has been subdivided into 28 units for homesteading by World War II veterans, and on the Hunt Unit of the Minidoka project in Idaho, where 89 units have been provided for the homesteaders, similar studies have been conducted to determine the acreage of the various classes of land necessary to provide an adequate farm unit. The land classification and topographic maps in each case have proved invaluable in establishing the farm unit boundaries. These boundaries follow the topography and natural land features whenever such a layout will prode a more satisfactory operating unit than when llowing legal subdivisions.

In conjunction with the layout of the farm unit, is necessary to make a survey to determine the act acreage of irrigable land that may be served the delivery to that particular farm unit. This commonly called an irrigable acreage survey. his survey is a joint engineering and agricultural eration. Here again, land classification maps ove invaluable in delineating the various classes lands suitable for irrigation from those of orer quality which are not suitable for irriga-n. In making this determination on the Hunt nit of the Minidoka project, a very satisfactory rangement was followed whereby a land classi-ation man accompanied the survey party and de the final adjustments in the land classifica-n and farm unit boundaries.

A suitable land classification provides the basic formation for a land development program de-ned to hasten the full production of the land. land-leveling operations on the Deschutes proj- in Oregon, where the depth of the soil is lim-d in some areas, it is essential to have a complete owledge of the soils in order that the fertility, isture-holding properties, and the effective pth of the soil will not be seriously impaired. il depth indicated in the land classification of is area prevents excessive grading.

For effective distribution and efficient use of ter, it is important to have proper length of furrow and proper spacing of the furrows or corrugations. For successful drainage, proper type, depth and spacing of drains are vital. These decisions may be made by evaluating the soils and substrata as to permeability and waterholding and transmitting properties. This information serves a useful purpose for a new project in its initial development period as well as for an older operating project.

For instance, during a recent classification of the Owyhee project in Oregon and Idaho, as on all other projects, the physical properties of the profile as to permeability and waterholding capacity were included in the land classification. As a result of this classification, recommendations for land use and cultural practices were made to the farmers through the local extension service. "Problem soils," packed so tightly that water cannot penetrate them, have been improved by the recommended practice of subsoiling or breaking up the compact layers.

The land classification information which proves beneficial in the development of land serves equally well as a basis for a sound land use or farm management program. Generally speaking, shallow soils are better adapted to hay and pasture than to row crops. It is also almost essential that the fertility of shallow soils be constantly replenished through a livestock program whereby a large portion of the products could be returned to the land. Thus, the land classification informa-

W MUCH WILL IT COST TO DEVELOP?—The ount of investment for such items os leveling d with carryolls on the Columbio Bosin project low) hos to be figured in selecting lcnd to be gated. Irrigable lands of the Posco Unit, ot ht. ***Photo below by F. B. Pomeroy, Region 1 otographer, ot right by H. C. Robinson, former gion 1 photographer.***

tion guides the land use and farm management program.

Since Reclamation law requires the repayment of project costs pertinent to irrigation, the ability of the lands to produce enough income to permit the waters users to repay the costs is of vital concern. When repayment contracts are drawn up for a project, one of the important things to be considered in arriving at the annual assessments is this "payment capacity" of the lands to be served by the project. In order to arrive at this "repayment potential," it is necessary not only to know the acreage of the various classes of land but the potential net income of these classes as well.

The assignment of variable repayment charges to different classes of land is necessary in all fairness to water users. This practice is operating successfully on Federal Reclamation projects in the United States and in many different irrigated communities throughout the world. ###

L. R. Fiock Retires from Rio Grande

L. R. FIOCK, left, congratulates his successor, William F. Resch, who takes over as manager of the Rio Grande project, El Paso, Tex. *Photo courtesy of the El Paso Times.*

After 41 years of devoted service with the Bureau of Reclamation, and its predecessor, the Reclamation Service, L. R. Fiock on June 27, 1952, retired as manager of the Rio Grande project in New Mexico and Texas, where he had worked for the past 30 years.

Scores of friends and employees assembled in the project office at El Paso, Tex., on that date to honor Mr. Fiock, who received a shower of gifts, scrolls, a medal and the Department of Interior Distinguished Service Award, highest honor bestowed by the Department.

The citation, signed by Secretary of Interior Oscar Chapman, and presented by Regional Director H. E. Robbins, lauded Mr. Fiock for his "eminent career" and praised his "economical, balanced and progressive" operation of the interstate project.

Director Robbins also gave Mr. Fiock a lifetime pass to all national parks and a scroll from the regional office staff stating that his "record will ever serve as an inspiration."

Mr. Fiock was born on August 21, 1886, at Yreka, Calif. He received his degree in civil engineering from the University of California in 1911.

Mr. Fiock joined the Bureau of Reclamation in May of 1911 as a surveyor on the Strawberry Valley project in Utah. He transferred to the Rio Grande project in January 1913, when the works were about 30 percent complete. He helped lay out the irrigation system and years later personally supervised the survey of routes for much of the Elephant Butte-El Paso and Deming power transmission lines.

William F. Resch, who has served with the Bureau of Reclamation in El Paso for 27 years, was named project manager to succeed Mr. Fiock, his former superior. •

Jack Savage Receives Another Honor

John L. Savage, world renowned "billion dollar" engineer, has been elected to the Hall of Fame of Popular Mechanics Magazine "as one of 5 Americans deserving honor of their fellow men for their achievements in the fields of mechanics, science, discovery, and for their contributions to the welfare of mankind during the past half century, 1902–52."

This award places Mr. Savage, designer of such structures as Hoover, Grand Coulee, and Shasta Dams, in the same class with such celebrated Americans as Henry Ford, Glenn H. Curtiss, Admiral Richard E. Byrd, Albert Einstein, and the Wright Brothers who also received this honor.

Savage, former Chief Designing Engineer for the Bureau of Reclamation, received this latest honor during the Popular Mechanics Golden Anniversary, the same year the Bureau of Reclamation is celebrating its Golden Jubilee. The scroll of honor was presented to Mr. Savage by Mayor Quigg Newton of Denver, Colo., at ceremonies held in the Reclamation Engineering Center at Denver, which were attended by more than 20 Bureau engineers, headed by Chief Engineer L. N. McClellan. •

ALTUS FARMERS SPEAK UP

PART 1—WATTS AND WALKER

by U. H. WARNER
Editor, The Geary Star, Geary, Okla.

Mr. U. H. Warner, publisher and editor of The Geary Star, a weekly newspaper published at Geary, Okla., is also President of the Geary Chamber of Commerce, an area-wide organization whose membership includes many of the progressive farmers from the surrounding country as well as business and professional men of the town of Geary.

Due to his interest in the proposed Canton irrigation project in the North Canadian River Basin in west-central Oklahoma, Mr. Warner has undertaken to tell the landowners in the project area, and the people of the nearby communities, what irrigation development will mean to them. As the W. C. Austin project in southwestern Oklahoma, about 95 miles southwest of the Canton project, is the nearest large scale irrigation development, Mr. Warner has sought these examples of nearby successful irrigation farmers so that the people in the area can acquire an understanding of the benefits of irrigation, both to the irrigation farmer and the surrounding community.

EARLIER THIS YEAR, we spent 2 days with farmers the Altus irrigation district in an effort to find what can be done in Oklahoma with irrigation. We found one man who harvested more than 25,000 worth of produce from one farm of 150 res in 1950. He did the same thing again last ar. Of course, the average farmer untrained in igation would be unable to make such a record thout many years of irrigation experience.

The story of Herman Watts, a native of the area ere he is now irrigating cotton, is a story which ıld be reproduced in Blaine county if irrigation ter ever flows down the North Canadian river lley.

Watts was born and raised on the land which joins his present farm. He had no previous igation experience when water came to his land a ditch in 1948.

Watts posed for his picture from the seat of his ctor which was pulling a harrow when we stopped at his place 2 miles north of the town of Martha.

"Would you consider leaving this area and going back to dry-land farming after growing four crops with irrigation water?" we asked.

Watts smiled knowingly, shook his head negatively, and started quoting figures.

"I have averaged 600 pounds of lint to the acre on my cotton in a 4-year period," he said, "and when I get a little more know-how on insect control, I will beat that all hollow. I used to be lucky to raise one-third of a bale before I had irrigation water."

"I planted my best field of 30 acres to cotton in 1951 and harvested 1½ bales to the acre. It would

EX-DRY-LAND FARMERS—At left, Herman Watts who had no previous irrigation experience prior to 1948, now making a success of his Altus farm. At right, Jack Walker, brought up on a dry land farm, has convincing evidence that irrigation pays in Oklahoma. ***Photos by Fred Finch, Region 5 photographer.***

have done over 2 bales to the acre if I had started fighting the worms a little earlier in the season. I had 90 acres of cotton all told and got a total of 104 bales.

"My 1952 program calls for 90 acres of cotton, 13 acres of castor beans, 30 acres of alfalfa, 8 acres of sweet clover, and a little sudan for pasture.

"Alfalfa has been a money-maker with irrigation water. My best yield to date has been 5 tons per acre for hay plus a seed crop which made 4½ bushels per acre."

Watts pointed across the field to a neighbor's farm. "There is Iris Kelly, a man who made $100 per acre net profit on castor beans on 100 acres," he said, "and I think that beans are going to be a big money maker for us here some day." He added that he intends to experiment some with beans this season.

Watts pointed south across the table land where one can see houses several miles away. He indicated a farm house where the original owner had sold his place at $125 per acre about the time irrigation ditches came through the valley. The man who purchased it has now sold the rolling 80 acres out of the original 160 for more than he paid for the entire place.

When asked what he values his land at today, Watts said he would not sell it for $300 per acre. He owns 80 acres and pays rent on 72 acres across the road from his land. The owner, who lives at Chickasha, collected $4,350 from Watts for his share of the crops on 72 acres in 1951. The landlord's share was one-third on the feed raised and one-fourth on the cotton.

Water at the Right Time

Jack Walker was sitting in his car, avoiding a cold north wind, while he watched the water flow down cotton rows one-half mile long when we stopped to talk to him on March 22. He stepped out of his car to pose for a picture beside the irrigation water which was soaking in to a depth of 10 inches on the 45-acre field which he planned to plant to cotton about April 15. We climbed back into the car and settled down for a series of questions and answers on irrigation of wheat. Walker said, "My dad raised me on a dry-land farm and when I grew up I started to farm. This thing of waiting on rains that fail to come at the right time finally disgusted me and I went into business in Altus and stayed there for 9 years.

"When I saw that irrigation was coming I realized that water which you can get in a ditch on the right day that you want it is real insurance for a farmer. I knew some good land to pick and bought it and was ready when irrigation came.

"Our average annual rainfall at Altus is 26 inches per year but we get only a little bit of it in the summertime when the crops are growing.

"The biggest trouble with our inexperienced irrigation farmers here at Altus is their failure to water at the right time. A man who should have watered last week looks up at the sky this week and sees clouds so he thinks, 'maybe it will rain. I will just wait until next week before I irrigate.' It doesn't rain, so next week he waters. But he waters two weeks too late."

Walker raised 157 bales of cotton on a 144-acre field in 1951, a season when worm damage cut yields considerably.

He wet his 1952 cotton field down 10 inches on March 22 and planted the cotton around April 15. He expected to run irrigation water down the cotton rows about the middle of July. If the weather stayed dry and hot the rest of the summer, he planned to irrigate about every 10 days through August and early September.

Mr. and Mrs. Walker live in a modern home at 728 East Commerce in Altus.

(NEXT MONTH—LAGREE AND HAFNER)

Water Users Take Over W. C. Austin Project

Water users of the Lugert-Altus Irrigation District took over the operation and maintenance of the W. C. Austin project on October 1st, marking the 100th contract under which operation of an irrigation system constructed under the Federal Reclamation program has been turned over to private water users by the Government.

In announcing the transaction, Commissioner of Reclamation Michael W. Straus said, "Relinquishment of responsibility over Federal projects to the water users as rapidly as they become able to assume the financial and administrative obligations involved, has been a fundamental policy of the Federal Reclamation program since its inception 50 years ago.

"As a result, the private water users now operate and maintain more than twice the number of systems run by the Bureau itself, and these latter will be still further reduced as soon as districts are able to take over the responsibility." •

Women of the West—

MYRA MARSHALL
Colonel Marshall's Helpmate


VAYS IN THE BACKGROUND, but always helpful and sympa-tic, Myra Marshall performed the gallant role demanded of the ves of many great men. *Photos, courtesy the Marshall family.*

by
A. L. EVANS, Editor and Co-Publisher
of the Lindsay Publishing Co., Lindsay, Calif.

MRS. ROBERT B. MARSHALL IS QUITE MODEST and kes little credit for herself, but she has given rvice to her country far greater than she realizes. She is the widow of Colonel Robert B. Marshall, 10 in 1891 had a vision, or dream, of the reclama-on of the valley of California, embodied in his arshall plan, and given to the people of Cali-rnia, without cost, in 1919.

The Marshall Plan which evolved into the pres-t Central Valley project is almost identical to e project as ultimately consummated.

In Marshall's own words he sums up the begin-ng of the project: "The first night from Nevada ty after driving about 40 miles was spent in e town of Folsom. I saw a lot of water in the nerican River as I crossed it. Was anybody ing it for irrigation?

"The next morning early, the road leading to alt (the next stop for the night) was along the uff south of Folsom. The morning was bright nshiny, blending the brown grasses and the few attered oak trees under a blue canopied sky—a eam landscape—and west, south and north I w the valley of California, in a natural buff can-s of endless beauty as far as the eyes could see. here were strips of green shades, and here and ere green splotches, mixtures of yellowish grass ubble fields, scattering oaks and strings of green along streams and stream beds under the blue sky canopy—all aglow with the untempered light of the November sun—and what a country!

"Then and there I paused—overpowered by the picture—an endless plain, and not a house in sight. In my mind came the thoughts: Irrigation, Major Powell's talks, alfalfa along Fountain creek, farms, colonial houses, fruit trees and vines, happy, laughing children, health, happiness, wealth, contentment.

"A new world lay before me. I pledged my effort that something must be done to reclaim those brown endless fields."

Then Marshall began to fight, to promote his dream, and finally in 1919 an appropriation was made by the legislature to carry on the work. Thus was set in motion the great Central Valley irrigation project.

Constant lecturing on, and promotion of, the project resulted in a severe throat ailment. An operation in Philadelphia removing the vocal organs, slowing him to talk only in a whisper, placed the burden upon his faithful wife, Myra.

Mrs. Marshall is the daughter of the late John Bradford Crow, an early settler of the San Joaquin Valley. Her father, for whom Crow's Landing is named, bought a large Spanish grant, a part of the Orestimba grant, southwest of Modesto.

Mrs. Marshall remembers well when most Californians thought her husband's plans were "plain crazy." And they didn't restrict their remarks to plans.

"Bob, you're crazy," they said when he announced that one of the world's biggest dams could be built where Shasta Dam now solidly reposes.

Mrs. Marshall met the man who was to become her husband while he was camped at Aspen Valley

AT THE MARSHALL MONUMENT—(from left to right) Mrs. B. Marshall, Miss Virginia Marshall, Mr. Evans, and Mrs. Evelyn Maddox. *Photo, courtesy of the Fresno Bee, submitted by the author.*

in charge of mapping California for the United States. She says of him that "he was a simple man and a practical man."

"Following the operation for incipient cancer of the larynx he never used his voice again," Mrs. Marshall said.

While Mrs. Marshall would interpret for him she never did so publicly. "I'm not a speaker," she said. "I get on my feet and just tremble."

Marshall spent his last years in San Francisco hoping that he would see the Central Valley project through. "He never gave up for a minute," his wife said.

He died in 1949, just 10 years after he attended the groundbreaking ceremonies for Friant Dam. There he said, "This brings to actuality my dreams of 48 years ago when I began my plan for the comprehensive, coordinated control and use of the water resources of California."

After Marshall died, Governor Earl Warren wrote Mrs. Marshall: "All California is indebted to him for his wisdom in laying the foundation of the Central Valley project and his courage in advocating it at the cost of his own health and at a time when public opinion was hostile."

When asked about the trials which she went through she replied, "You know, I never minded those hard years. What wife wouldn't fight along beside her husband?"

Mrs. Marshall is a woman of culture and refinement. Widely traveled, she is conversant with many parts of the world. Her intellectual grasp of situations is very keen and in her 83 years she exemplifies wisdom and clarity. Mr. Marshall surely had a helpmate who was devoted and competent. Her great service to a great man who had a great idea should be remembered by the millions who will benefit from the huge governmental works of reclamation.

The gratitude of the people of Lindsay for the Reclamation water was expressed in a monument to Marshall which was dedicated and placed in the city park in April 1950. The monument was a large core of foundation rock from the Friant damsite and a bronze plaque said: "Erected in honor of Colonel Robert Bradford Marshall whose vision and untiring service made possible the Central Valley project." Had it not been for this project thousands of rich orchards would have perished.

The daughter, Virginia, in expressing her mother's service to her father said "she gave him the courage that he needed."

Virginia lives with her mother at 2523 Gough Street, San Francisco, Calif. The other daughter, Mrs. Evelyn Maddox, makes her home in Sacramento, Calif. # # #

N. R. A. to Meet in California

The annual convention of the National Reclamation Association is scheduled to be held at Long Beach, Calif., November 12 through 14. This will be their twenty-first annual meeting. •

Reclamation Man Heads Western Soil Scientists

Maurice N. Langley, head of the land use and ttlement branch of the Lower Colorado River istrict, Yuma, Ariz., was elected president of e Western Society of Soil Science, an organizaon of the leading professional and industrial ils men in the western United States, who cently met at Oregon State College, Corvallis, reg.

This represents the fourth year that Langley s held office in this organization. •

Boysen Dam Dedicated

Boysen Dam on the Big Horn River in Wyomg, the eleventh major structure to be completed the Missouri River Basin project, was dedited on August 2 at a celebration attended by eclamation Commissioner Michael W. Straus d other reclamation officials.

During the ceremony, Mr. Straus paid tribute Major John Wesley Powell, the great geologist, hose vision almost a century ago brought about e present-day development of the Missouri iver Basin project. The Boysen unit will prode 15,000 kilowatts of power for the people of the ea, has possibilities for irrigating nearby farm nds, and has already proved its value as a recreaonal center. See article entitled "Fishing at oysen" on page 213 of last month's issue. •

No Swimming—Yes?

To answer the many queries about our August ont cover, the photo was taken by Charlie Knell, egion 6 photographer, one hot June day back in 50. Sam Larsen, author of the story, "No wimming—Stay Alive by Staying Out," tells us at the photo was taken in what used to be his ick yard. He says that the water is not deep iough to be dangerous there as the canal is not large one. When he was Superintendent of the elle Fourche project, the principal hazards to the ids were in connection with eating strawberries nd green apples out of his garden. F. C. Winkr, the present project manager, has fixed up the ole by putting in a gravel bottom and the neighors have a volunteer arrangement to keep an ye on the youngsters while they are in the ater. •

Land Office Business at Columbia Basin

The old phrase "doing a land-office business" has become something more than just an old phrase on the Columbia Basin project, where each farm unit that becomes available for sale is met with a deluge of applications from veterans and others anxious to own their own farms.

The first land drawing involved 84 units and 158 applications were received. In succeeding drawings, more and more applications for each unit poured in. So far, 14,564 applications have been made for the 261 units which have been offered in the last 8 public announcements, for an average of 55.8 applicants per unit. One recent announcement which offered 9 units drew a flood of some 2,817 applications from enthusiastic would-be Columbia Basin farmers. •

Vetter Heads Large Dam Commission

Carl P. Vetter, Boulder City, Nev., Bureau of Reclamation engineer has been elected Chairman of the United States Committee of the International Commissions on Large Dams, an international organization for advancing engineering techniques for building and operating high dams.

Vetter, who was elected at a meeting of the United States Executive Committee in Washington, D. C., took office upon expiration of the term of Gail A. Hathaway of the United States Army Corps of Engineers in September. Vetter has been a member of the committee since its reorganization after World War II.

As Chief of River Control of the Colorado River, Vetter's normal job is to regulate the flow of the lower river through operation of Hoover (Boulder), Davis, Parker, and Imperial dams.

The Executive Committee of the international Commission, representing 24 foreign countries, met this fall in Chicago coincident with the principal meeting of the centennial of the American Society of Civil Engineers. •

Comptroller Denit Resigns

W. Darlington Denit, who has served as Assistant Comptroller and Comptroller in the Bureau since 1948, resigned his post on July 17 to enter private business. His assistant, William Peratino, was named acting Comptroller.

CROPS

Castor Beans Meet Aircraft Needs

Irrigation in California's Imperial Valley again demonstrated the tremendous strategic importance of Reclamation. Seventeen thousand acres in the Imperial Valley were planted to castor beans from which an essential lubricant for jet aircraft engines is obtained. The long growing season and fertile soils of the Valley make it an ideal locale for "custom tailoring" to the Nation's highly specialized agricultural needs.

Reclamation Crops Top ¾ Billion Dollar Mark

Crops valued at $821 million were grown on Reclamation projects in the 17 Western States during 1951 to set an all-time record for crop income. The top per acre value was $2,500. The over-all total income exceeded that of the previous year by a quarter of a billion dollars and thoroughly reflected the impact of new acres and greater production on federally irrigated lands. It also indicates that still larger returns may be expected from large projects now nearing completion when they go into full production.

Top-value crops for 1951 included tomatoes from the Coachella Division of the All-American Canal project in Southern California, $2,500 per acre; strawberries from Salt River project in Arizona, $2,200 per acre; flowers from Rio Grande project, New Mexico and Texas, $2,118 per acre, and nursery products from Lewiston Orchards project in Idaho $2,000 per acre. The Coachella Division rated first in the largest number of premium crops (those returning $500 or more per acre) with 15 varieties. Salt River and Central Valley tied for second place, each with 12 varieties grown. The combined values of these crops was almost $32,600,000. All told, on 34 projects (about half of the Bureau's total of 69) farmers produced crops valued at more than $500 an acre.

Commissioner Straus pointed out that as the older projects attain full production and the newer ones make their increasing contribution to the world food supply, the Nation can count upon Reclamation soon to furnish an annual billion-dollar addition to its economic structure. A significant part of the increases in crop production resulted from the extreme flexibility of irrigation farming and its ability to adapt production to national needs. More than $100,000,000 of this total increase in crop value came from acres receiving irrigation water from Bureau of Reclamation facilities for the first time.

The cumulative value of crops produced on Reclamation projects is now about $8 billion. This is four times the approximate $2 billion spent on all Reclamation works to date. •

LETTERS

A Civil Engineer and a Captain

Among our letters this month, we were proud to receive the following indications of the widespread interest in our official publication.

48th Supply Squadron
48th Fighter Bomber Wing
APO 119
c/o Postmaster, New York, N. Y.

DEAR SIRS: Enclosed is a check for $1.50 for 1 year's subscription to your very fine magazine, the Reclamation Era. Please note my change of address.

Very truly yours,
CAPTAIN JOE STAHL.

133 Noble Street
Brooklyn 22, New York

DEAR SIRS: I am a civil engineer and have just returned from a rather extensive tour of many of your projects in the far west and was tremendously impressed by the wonderful work going on out there and particularly at the Denver Federal Center Laboratory.

I would like to keep further informed on this work by subscribing to your periodical "Reclamation Era." Enclosed please find a check for $1.50.

Respectfully yours,
STEPHEN MIKOCHIK.

Banker's Friend

From the First National Bank, Glasgow, Mont., comes this gratifying note regarding the Bureau of Reclamation's official publication:

DEAR SIR: I just received my first copy of the Reclamation Era. I'm very pleased with them and especially since both the June and July Issues contain articles on our own Milk River Project.

The articles and information will be ... me to better acquaint myself with Reclamation and Irrigation projects and procedures.

Also these copies are placed in our lobby in a special farm bulletin rack for people to study.

Very truly yours,
STEPHEN J. URS,
Agricultural Representative

Good Reading for Chamber of Commerce

DEAR MRS. SADLER: We discovered with much interest and pleasure the fine article, "Yuma—an investment that makes cents" in the June issue of the Reclamation Era.

Could we get permission to reprint this article, with full credit of course, in the monthly publication of the Yuma County Chamber of Commerce? I have enclosed a copy for your information.

I happen to be in charge of editing the publication for the Chamber this year, and I think this one would make fine reading for our members.

Sincerely,
JONES OSBORN,
Publisher, The Yuma Daily Sun

Permission gladly given—Ed.

Boys and Butter

Box 134, WILLOWS, CALIF.,
May 22, 1952.

DEAR MADAM: The front page picture of the February issue of the ERA recalled to my mind one I took of Mr. Crouch and my youngest grandson ... years ago when I was caretaker at the Stony Gorge Reservoir (Orland project, California) from 1928 to 1937. Mr. Crouch passed away May 9, 1951, and my grandson, Gene Clow, reaches his majority tomorrow and has passed his physical examination for the Navy.

hoto of 19 years ago by Jonas H. Crouch, Orland project

Our cover for February '52.

f you care to use this picture, do so. would appreciate its return as it is last one I have and I can't find the n.

Sincerely yours,

JONAS H. CROUCH.

Here are both photos—the February 2 cover and Mr. Crouch's picture en in 1933, proving that times do change very much, after all, and re is something fascinating about a tter churn—particularly to very ung boys.—Ed.

A Comment from Colorado

Thanks to Mr. Marc G. Williamson r this complimentary note to Comssioner Michael W. Straus:

Tell Mike Straus for me that he and s helpers are doing a H . . . of a od job on the ERA.

RELEASES

The Status of Planning Reports

Before the dirt begins to fly on a nstruction job for a reclamation projt, money has to be appropriated by e Congress. Before that, the project ust be authorized and repayment conacts negotiated so that the Governent's investment is protected. Even fore a project reaches this stage, the lan for the project must be carefully nsidered by the States and other gencies who will be affected by the am, reservoir, power plant, or other tructures designed to conserve western ater resources, and develop them for he maximum benefit of the greatest nmber of people.

At the present time, four reports approved by the Secretary of the Interior are circulating among the interested States and Federal agencies for review and comment. These reports are on the Trinity River Division and Sacramento Canals Unit of the Sacramento River Division, both of which are part of the Central Valley project (Ultimate Development), in California; the Canton project of Oklahoma, and the Santa Maria project of California. When the comments of the reviewing agencies are received, they are incorporated in a final report which is approved and adopted by the Secretary of the Interior prior to its transmittal to the President of the United States, via the Bureau of the Budget.

Occasionally after compiling the necessary surveys, investigations, charts, maps, and tables which are required before a project can be authorized, designed and constructed, the engineers and other technicians of the Bureau and cooperating agencies find that the project is not feasible from an engineering, economical, agricultural or other standpoint. In such cases, even though the law does not require it, the planning reports are sent to the interested States and Federal agencies for their information, with the notation that the Secretary of the Interior does not recommend authorization and construction by the Federal Government at the particular time. At present there are three reports on projects thus considered infeasible, which have been recently transmitted to the Secretary for his final approval after being reviewed by the interested States and Federal agencies. These are on the Payette Heights Unit of the Payette Division of the Boise project in Idaho; the Fort Gibson project in Oklahoma; and the Braziel Dam and Reservoir in Nebraska—proposed as supplemental works for the Fort Laramie Division of the North Platte project in Wyoming and Nebraska. After the Secretary has given his final approval to these reports and the recommendations contained therein, these unfavorable reports are also transmitted to the President with the reviewers' comments for information and future reference.

The report on the Colorado River Storage project and Participating projects to be located in the Upper Colorado Basin States has been reviewed by the States and Federal agencies, and is now awaiting final action by the Secretary of the Interior and transmittal to the President. Also awaiting final action by the Secretary is the report on the Swan Lake project to be located near Ketchikan, Alaska, which has been reviewed by the interested States and Federal agencies.

Favorable reports are transmitted in accordance with the provisions of the Flood Control Act of 1944 (58 Stat. 887), act of August 14, 1946 (60 Stat. 1080), and voluntary agreement between the Federal agencies concerned with water resources. As stated above, unfavorable reports are transmitted on a purely voluntary basis. ●

Central Valley Booklets

The Bureau of Reclamation recently released three illustrated folders containing information regarding the Central Valley project, entitled as follows. "Central Valley Project," "Shasta Dam," and "Friant Dam." A limited supply is available free of charge from the Bureau of Reclamation, Supply Field Division, Attention: 841, Building 53, Denver Federal Center, Denver 2, Colo.

Land Reform—A World Challenge

The State Department recently released an 80-page booklet entitled, "Land Reform—A World Challenge" containing statements regarding the problems of land tenure in the world. This publication is for sale by the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for 20 cents a copy.

NOTES FOR CONTRACTORS

Contracts Awarded During August 1952

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DS-3695	Missouri River Basin, N. Dak.	Aug. 26	12 lots of very high-frequency radio equipment and 20 mobile radio transmitter-receiver combinations for Missouri-Souris District, schedule 1.	Radio Corp. of America, Camden, N. J.	$37,910
DC-3721	Central Valley, Calif.	Aug. 11	Construction of earthwork and structures for lateral 6.2 and sublaterals, for east section of Unit 1 on Madera distribution system.	H. Earl Parker, Inc., Marysville, Calif.	2,096,200
DS-3728	Missouri River Basin, N. Dak.	Aug. 25	One 15,000-kilovolt-ampere transformer with 3 lightning arresters for Washburn substation.	American Elin Corp., New York, N. Y.	103,425
DS-3730	Missouri River Basin, Wyo.	Aug. 12	1 controlling and 2 controlled station supervisory control and telemetering switchboard sections and associated equipment for Thermopolis and Lovell substations and Boysen power plant, schedule 1.	Control Corporation, Minneapolis, Minn.	23,540
DS-3735	Davis Dam, Ariz.-Nev.	Aug. 29	One 69,000-volt circuit breaker for Cochise substation, schedule 1.	Brown Boveri Corp., New York, N. Y.	13,539
DS-3736	Central Valley, Calif.	Aug. 13	One 50-ton gantry crane for Nimbus power plant	Judson Pacific-Murphy, Emeryville, Calif.	98,300
DS-3738	do	Aug. 12	Six 10.5- by 12.25-foot fixed-wheel gate frames for intakes at Nimbus power plant.	Valley Iron Works, Yakima, Wash.	26,500
DS-3740	Missouri River Basin, Mont.	Aug. 29	3 horizontal-shaft, centrifugal-type pumping units for Crow Creek pumping plant.	Economy Pumps, Inc., Philadelphia, Pa.	48,810
DS-3741	Missouri River Basin, S. Dak.	Aug. 25	One 15,000-kilovolt-ampere transformer with 6 lightning arresters for Weaver substation.	American Elin Corp., New York, N. Y.	85,535
DS-3749	Central Valley, Calif.	Aug. 15	Six 10.5- by 12.25-foot fixed-wheel gates for intakes at Nimbus power plant.	Pacific Coast Engineering Co., Alameda, Calif.	39,18[illegible]
DC-3751	Colorado-Big Thompson, Colo.	Aug. 13	Construction of Parshall flume and inlet for Aspen Creek siphon, power canal No. 1.	Crocker and Ellett, Inc., Denver, Colo.	99,115
DC-3753	Missouri River Basin, Mont.	Aug. 29	Construction of Toston tunnel and access road	A. J. Cheff Construction Co., Seattle, Wash.	326,964
DC-3755	Central Valley, Calif.	Aug. 25	Construction of earthwork and structures, turn-out extensions, and 13 venturi meter installations for Friant-Kern canal.	Gardner and McCall, Long Beach, Calif.	77,405
DC-3766	Columbia Basin Wash.	Aug. 22	Cleaning and painting floating caisson, caisson drydock, and accessory equipment at Grand Coulee Dam.	Runnels Paint Co., Seattle, Wash.	24,600
117C-148	do	Aug. 25	Ringold Pumping Plant to Babcock Pumping Plant 13.2-kilovolt transmission line.	G. A. Estep Electric Co., Yakima, Wash.	37,524
100C-148	Minidoka, Ida.	Aug. 27	Drilling 5 water supply wells	Commons Drilling Co., Rupert, Idaho	21,045
100C-149	Hungry Horse, Mont.	Aug. 21	Relocation of east side Forest Service telephone line. section 3a.	Robert D. Claxton, Somers, Mont.	27,038
200C-206	Central Valley, Calif.	Aug. 12	Shoulder drains, drain crossing, and road culvert, Delta-Mendota Canal.	Dana R. Tyson Co., Sacramento, Calif.	15,630
200C-207	do	Aug. 21	Constructing 5 radio reporting rain and snow gage stations.	M. C. Balwin and A. E. Mangs, Watsonville, Calif.	12,900
200C-208	do	Aug. 19	Constructing temporary headquarters at Nimbus Dam.	Waterbury and Chapek, Sacramento, Calif.	37,573
300S-37	Davis Dam, Ariz.-Nev.	Aug. 21	161-kilovolt power circuit breaker for Knob substation; schedule 1.	Brown Boveri Corp., New York, N. Y.	34,211
300C-39	Gila, Ariz.	Aug. 5	Gravel road surfacing for Mohawk and Wellton canals and construction of Ligurta Creek dike.	James E. Roberts, San Bernardino, Calif.	90,00[illegible]
605C-18	Missouri River Basin, Mont.	Aug. 25	Drilling holes for groundwater investigations at Yellowtail dam site.	Vivian Brothers, Kellogg, Idaho.	16,862
601C-24	Missouri River Basin, Wyo.	Aug. 22	Transmission line connecting road at Boysen Dam	Ready Construction Co., Thermopolis, Wyo.	13,160
703C-265	Missouri River Basin, Nebr.	Aug. 12	Construction of Ogallala substation	Commonwealth Electric Co., Lincoln, Nebr.	26,791

Construction and Materials for Which Bids Will Be Requested by December 1952

Project	Description of work or material
Cachuma, Calif.	Construction of chain-link fence around Glen Anne Reservoir area, 9 miles north of Santa Barbara, Calif.
Central Valley, Calif.	Construction of remaining portion of Contra Costa canal distribution system, consisting of 15.8 miles of of 12- to 60-inch diameter reinforced concrete pressure pipeline between Antioch and Martinez, Calif., for Contra Costa County water district. Work includes furnishing and laying pipe, constructing moss screen and turn-out structures, installing stationary moss screens, gate valves, meters, slide gates, pipe vents, and air valves.
Do	Construction of 16 miles of precast 12- to 48-inch diameter concrete pipelines for unit 2 of Saucelito irrigation district on the Friant-Kern canal distribution system. Work includes construction of monolithic moss screens and pumping plant structures and installation of moss screens and pumping units. Located east of Pixley, Calif.
Do	Construction of Camp Creek diversion dam, a concrete overflow weir 44 feet long and 10 feet high built on a rock foundation. Work also includes construction of a 70-foot-long headworks, including a 7- by 7-foot radial gate, which diverts water into Camp Creek tunnel and finally into Sly Park Reservoir. Work located on Camp Creek, 2 miles east of Sly Park, Calif.
Central Valley, Calif. (Continued)	Construction of 32 miles of unlined or earth-lined laterals varying in width from 6 to 18 feet, for the north section of Madera distribution system's unit 1, near Madera, Calif.
Do	Two 5,000-volt, metal-clad switch-gear assemblies with two 250,000-kilovolt-ampere air circuit breakers in each assembly for Nimbus power plant.
Do	360,000 pounds fabricated galvanized structural steel for bolted switchyard structures at Folsom and Nimbus power plants.
Do	4 motor control cubicles for controlling 2,300-volt synchronous motors for the Contra Costa pumping plants.
Colorado-Big Thompson, Colo.	Installing gravity drain for stilling basin on Horsetooth feeder canal, 5 miles west of Fort Collins, Colo
Columbia Basin, Wash.	Construction of 6.5 miles of 30 cubic feet per second capacity channel for interception and conveyance of excess ground water in the vicinity of Soap Lake, Wash. Work includes lining the channel with 3-inch concrete and construction of a 20-foot drop structure and four road crossings.
Do	Repair of breaks in the lined sections of the East Low canal in the vicinity of Rocky Coulee siphon, either by intrusion grouting or by removing existing concrete lining, backfilling with select materials and placing new concrete lining.

Project	Description of work or material
umbia Basin, ash., (Con.)	Construction of a 34-mile reach of unlined East Low canal, varying in capacity from 1,490 to 550 cubic feet per second and a base width of from 22 to 20 feet, to extend south from Warden, Wash.
Do	Construction of 56 miles of unlined laterals, sublaterals, and wasteway, varying in capacity from 2 to 232 cubic feet per second and in bottom width from 2 to 16 feet, for lateral area P-8 on Potholes East canal, near Eltopia, Wash. Work also includes construction of drops, checks, turnouts, weirs, and nine outdoor type pumping plants of 3 to 118 cubic feet per second capacities.
Do	Three 45 cubic feet per second pumping units for Warden plant, three 13.7 cubic feet per second and two 8 cubic feet per second pumping units for Warden relift plant, three 24 cubic feet per second pumping units for EL-63.1 plant, one 9 cubic feet per second pumping unit for EL-63.1E plant, two 7 cubic feet per second units for EL-61.7 plant, and two 8 cubic feet per second units for EL-61 plant, all on East Low canal.
s Dam, Ariz.-v.	Erecting steel structure and mounting 161-kv buses and switches for Buckeye substation near Buckeye, Ariz. The steel and electrical equipment is Government-furnished.
Do	Installation of unit substation and other electrical equipment, erection of steel structures, and construction of concrete foundations for the 8,000/10,000-kilovolt-amperes Maricopa substation near Maricopa, Ariz.
Do	One 28,667/35,833-kilovolt-amperes and one 25,000-kilovolt-amperes transformer for Prescott substation.
souri River sin, Nebr.	Construction of 20 miles of Bartley canal near Bartley, Nebr. Main structures are siphons, overchutes, culverts, turnouts, and timber bridges.
Do	Construction of Bartley diversion dam, a concrete overflow weir 1,100 feet long and 3 feet high above river bed. It will have steel sheet piling cut-offs, sluiceway, and canal headworks. Dam is to divert water into Bartley canal for irrigation of land on the south side of the Republican River. Dam site near Indianola, Nebr.
Do	Construction of 2.4 miles of 685 cubic feet per second capacity Courtland canal, 3 miles southeast of Superior, Nebr. Work includes 9 embankment sections which are to serve also as detention dams, 5 timber bridges, 2 drainage inlets, 2 lateral turn-outs, 9 detention basin evacuation conduits, and 0.4 mile of unreinforced concrete canal lining.
Missouri River Basin, Kans.	Construction of Webster earthfill dam foundation, involving 400,000 cubic yards of excavation for cut-off trench, and placing 1,000,000 cubic yards for a portion of dam embankment. Dam site is on the south fork of the Solomon river, near Webster, Kans.
Do	Painting certain exposed metalwork, piping, and conduits in Boysen power plant and switchyard, about 20 miles south of Thermopolis, Wyo.
Missouri River Basin, Mont.	Constructing two 3-bedroom permanent type residences with water-supply well and septic tank or other sewage disposal means at Missouri diversion dam site near Frazer, Mont.
Missouri River Basin, S. Dak.	Construction of 15,000-kilovolt-amperes Weaver substation for the Air Force base near Rapid City, S. Dak.
Missouri River Basin, Wyo.	Construction of 2,000-kilovolt-amperes North Cody substation near Cody, Wyo.
Missouri River Basin, Kans.	Completion of 105-foot high by 12,600-foot long Kirwin earthfill dam, located on the north fork of the Solomon River near Kirwin, Kans. Work consists of excavation for structures, completion of excavation for foundation of dam, completion of dam embankment and construction of concrete structures. Concrete construction will include a 400-foot wide spillway with chute and stilling basin, a canal outlet works with conduit, intake structure, gate chamber, stilling-well, and a concrete-pipe river outlet with stilling basin. Installation of high-pressure gates will be required in the spillway sluices and in the outlet works.
Missouri River Basin, S. Dak.	Construction of Missouri River crossing for Oahe-Midland 115-kilovolt transmission line. Work includes constructing foundations and erecting steel towers, furnishing and stringing conductor and ground wire for a 2,400-foot long crossing span and two 800-foot anchor spans.
Missouri River Basin, S. Dak.	Constructing foundations for and erecting steel towers; installing de-icing switches and transformers; furnishing and stringing conductor and ground wire for transmission line approaches to Fort Randall switchyard and dam near Fort Randall, S. Dak.
Missouri River Basin, Mont.	Three 6,667 kilovolt-ampere generators for Little Porcupine power plant.
Palisades, Idaho	Four oil pressure, cabinet-type actuator governors for regulating speed of four 39,500-horsepower hydraulic turbines for Palisades power plant.
Do	Four 35,000-kva transformers for Palisades power plant.
Shoshone, Wyo	Construction of less than 0.5 mile of 10 cfs capacity laterals with 5 turnouts and 4 small drop structures.
Do	Leveling building sites of Heart Mountain camp area and obliterating 12 miles of roads.

United States Department of Interior, Oscar L. Chapman, Secretary

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THE RECLAMATION AREA

The Reclamation ERA

November

1952

Official Publication of the Bureau of Reclamation

November 1952

Volume 38, No. 11

The Reclamation ERA

35 Years Ago In The Era

The Harvest of 1917 Has Been Garnered

The granaries are filled with cereals. Huge stacks of forage are clustered about the feed lots. Livestock of all kinds is in good condition. And the storage cellars are filled with vegetables. Approaching winter finds the project farmer satisfied with the result of his labors and the assurance of good demand and prices for all crops.

The Reclamation Service closes the season with reports of good progress in all lines of construction, of satisfactory delivery of water to a greatly increased acreage, and a continuance of cordial relations between the farmers and the operation forces.

Notwithstanding the stress and worry incident to the crisis through which we are passing, the service and the people have much to be thankful for this year.

ARTHUR P. DAVIS

(From the front cover of the November 1917 issue of the RECLAMATION RECORD, predecessor to the RECLAMATION ERA).

OUR FRONT COVER—TIBER DAM, FIRST CONTRACT AWARDED ON THE "NEW STARTS" (see p. 227, September 1952 issue). Here, Robert J. Kennedy is sighting through a transit at Tiber damsite south of Chester, Mont. On October 1, President of the United States Harry S. Truman visited the scene of construction and pushed a plunger, setting off the first explosion. Tiber Dam, key water-control feature in the Lower Marias Unit of the Missouri River Basin project will be an earth-fill structure, 4,300 feet long and 205 feet high, with a dike 17,000 feet long and 60 feet high. The reservoir, extending 25 miles upstream, will provide storage capacity for 1,337,000 acre-feet of water.

OUR BACK COVER is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners Kittredge and Coolidge.

DESIGN AND ILLUSTRATIONS by Graphics Section, Bureau of Reclamation, Washington, D. C.

R. F. Sadler, Editor

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In this issue . . .

RECLAMATION PLACE NAMES IN THIS ISSUE

IN 1948—3½ BALES PER ACRE were grown on the Number 1 first foundation field of high yielding, high quality . . .

ARIZONA 44 COTTON

by PROFESSOR E. H. PRESSLEY, Plant Breeder

College of Agriculture and Agricultural Experiment Station,

University of Arizona, Tucson

When Professor Pressley began his cotton breed- g work at the Arizona Experiment Station, cer- in spinners were casting aspersions against "ir- gated cotton," believing it to be inferior in ength and spinning qualities to rain-grown cot- n, even though yields under irrigation were gher. Professor Pressley's job was to determine hether breeding could improve the quality of the er as well as the quantity.

As there was no mechanism available for quick- sting individual plant selections, Mr. Pressley signed and constructed the Pressley strength ter to enable the breeder to propagate only nts with strong lint or fiber. Consequently nners are now assured that new selections sent them for testing are known to be strong. Mr. essley's success in developing the superior varie- s of cotton now grown by Arizona farmers has oved that "irrigated cotton" is among the best.— ofessor W. E. Bryan, Head, Department of ant Breeding, College of Agriculture and Agri- ltural Experiment Station, University of izona.

ARIZONA 44 APPEARS TO BE THE BEST BET for "irrigated cotton" growers in Arizona so far as production and spinning quality are concerned.

In 1941, as part of a general cotton breeding program, we crossed many southern varieties with each other as well as with varieties being commonly grown in the irrigated areas. Among these crosses was one between New Mexico 1517 and Santan, a local strain of California type Acala. The New Mexico 1517 variety represents the first "break" in the prejudice against irrigated cotton, as it has the longest fiber (approximately 1⅛″) of the "upland" types of cotton, has exceptional strength, and good spinning quality. It was developed at high altitudes of about 3,800 feet and is adaptable to high, cool mountain valleys. In the hot, low valleys of Arizona this medium staple cotton did not have as high a yield.

Santan, on the other hand, was developed from the California Acala and was well adapted to hot

THE PRESSLEY STRENGTH TESTE
This device, which somewhat reser bles a weighing machine, is used determine the strength of cott fibers. The two halves of the "breal ing clamps" are shown in the for ground. *Photo submitted by the a thor, and inventor of the testir machine, E. H. Pressley.*

valleys, having an excellent yield, but with a less desirable fiber quality.

The result of crossing the "high altitude" New Mexico 1517 with the "low altitude" Santan was Arizona 44, which combines the former's spinning quality with the latter's high yield.

Nothing of value was obtained from crosses involving southern varieties, and so far in our cotton breeding program we have discarded most of the other strains, although breeding work is being continued in the hope of achieving further improvement.

By 1946 several of the strains coming out of the cross between 1517 and Santan were sufficiently uniform to make the first test, at which time Arizona 44 appeared to be one of the best from the standpoint of yield. Cotton breeding often involves crossing of varieties to increase segregation which provides a wider range for selection. Then the job is to make selections from the segregating generation to get the desired combinations of characteristics carried by the parents. After the cross has settled down to a uniform type, a seed program may be started in which foundation seed is planted, from which registered seed is produced, and which in turn provides the certified seed for the grower. It takes about five or six generations to get a new variety stabilized.

In 1947 we began a thorough program of testing, in cooperation with the United States Cotton Field Station at Sacaton, Ariz. Three locations were selected: in Maricopa County we had the Mesa Experimental Farm, and in Pinal County we had plots at Sacaton and near Casa Grande.

At the end of the 1947 season we discarded four strains and during the next 4 years included eight new strains and varieties. Between 1947 and 1951 we made spinning and other tests on a tot of 123 plots for each variety grown at the severa locations.

For comparison with Arizona 44, we used th formerly popular P18–C cotton, a medium stap cotton with a fiber length of about $1\frac{1}{16}$ inche which, although it lacks fiber strength, is pa ticularly adapted to irrigation. Arizona 44, how ever, out-yielded P18–C in 11 out of 14 separa tests despite the fact that during the 5-year tes ing period weather conditions varied considerabl For all tests run over the entire period, Arizon 44 came out ahead by 4.2 percent or an average 43 pounds of lint per acre, representing an ave age yield of over 2 bales an acre.

The greatest gain achieved with the new variet is in the strength of the yarns which is considere the most important reliable single index of spi ning quality. For the 14 spinning tests conducte the average breaking strength of "22s" yar made from Arizona 44 has been 122.3 pound (22s is one of the standard laboratory yarn num bers, used for testing the spinning qualities cotton. Other standard yarn numbers are 1 36s, 44s, 50s, 60s, 80s, and 100s, assigned accordir to the number of cotton skeins per pound.—Ed This means that it would take a 122.3 pour weight to break a skein of yarn made of Arizo 44 cotton. In the same series of tests 22s ya made from P18–C had an average breakir strength of 108.4 pounds. According to ya strength classifications as set up by the Producti and Marketing Administration who made t tests, anything above 119 pounds for 22s yarn excellent.

Other gains have been made in spinning qualit other than strength. For example, Arizona ton has 12 percent fewer "neps," or small knots, r 100 square inches of card web, than P18–C. appearance, Arizona 44 is one-half a grade tter than the P18–C, making it more desirable r use in higher quality fabrics. There is very tle difference in staple length or in the per- ntage of waste between the two. There is some riation in the fineness of Arizona 44 cotton, ich may eventually result in further improving spinning quality. At present the fibers are parently a little too fine for the production of e best quality yarns, although some spinners ve reported good results by blending it with arser cottons.

In the past 2 years we made spinning tests on two rizona 44 families, one having the coarsest and e other the finest fibers. Both in 1950 and in 1951 e coarser fiber produced yarns with an appear- ce index of 110—considered good by testing andards, while the finer fiber was graded at 100, average.

If we get the same results after further intensive sts this year, we will remove the finer fibered milies from the parent seed to improve consid- ably the spinning quality of Arizona 44 fiber in e course of a few years.

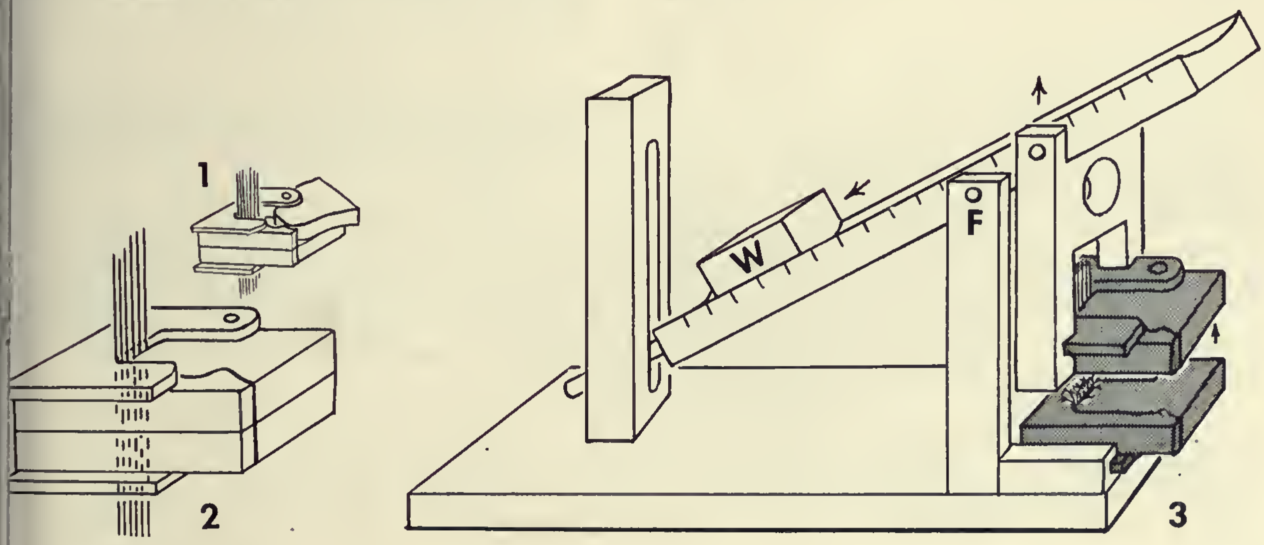
Arizona 44 has been accorded a much better reception by spinners than has P18–C, against which there has been so much prejudice that some buyers have stated they will purchase no Arizona cotton so long as P18–C is being grown, and others now indicate that they would use much more Arizona 44 but for the possibility of getting some P18–C at the same time. It appears now that P18–C may be completely out of the picture in a few more years.

Since a few growers have brought up the question of the seed of Arizona 44 "running out," some explanation should be given regarding the plans for maintaining the purity of the variety. An organization whose membership consists of growers of pure cotton seed, known as the Arizona Cotton Planting Seed Distributors, has been set up to take care of the production of planting seed of approved varieties, and to furnish them to the growers at the least possible cost.

According to an agreement between this organization and other interested parties, the Plant Breeding Department of the University of Arizona will each year supply the seed distributors with from 15 to 20 pounds of selfed Arizona 44

(Please turn to page 258)

)W STRONG IS THE FIBER? The Pressley Strength Tester helps answer this important question. First a sliver (pronounced gh-ver) or small roll of cotton is combed into tufts, about 2 ches long. From one of the tufts a ¼-inch wide "ribbon" of t, parallel strands of cotton is combed and placed in a set of eaking clamps, as shown in figures 1 and 2. When trimmed and serted in the clamps, the ribbon becomes a "bundle." The amps are inserted in the Pressley tester as indicated in the exaggerated and simplifield figure 3. As the weight moves down the eam, the bundle of cotton reaches its breaking point, the clamps ck apart, and the sliding weight stops, indicating to the nearest one-tenth of a pound, how much "pull" it takes to break this particular sample. The two broken pieces of the bundle are carefully picked up with tweezers and placed in a weighing device to determine the bundle's weight to the nearest hundredth of a milligram. From these figures, cotton testers figure how many pounds per square inch it takes to break a bundle 1-inch square. Six "breaks" and "weighing's in" are made on each sample, and two people make three each to assure accuracy and take care of variations in handling the sample. *Drawing by Graphics Section, Washington, D. C., based on information from the Cotton Branch, Production and Marketing Administration, United States Department of Agriculture.*



225526—52——2

FOUR-WAY PROTECTION along the West Canal, Columbia Basin project, within the city limits of Ephrata, Wash. Fenced banks, locked access gates, warning signs, and the means for escape a provided for the unwary if all these precautions fail.

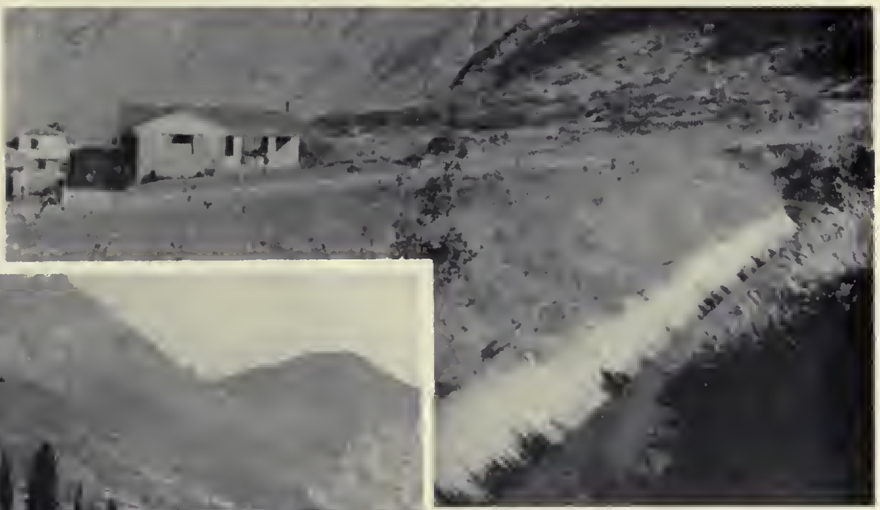
CANAL SAFETY IS OUR BUSINESS

by R. J. WILLSON, Assistant Operation and Maintenance Liaison Representative, Design and Construction Division, Denver, Colo.

"92 KNOWN DEAD" would easily make the headlines if the tragedy were the result of flood, fire, train wreck, explosion, or other major catastrophe. But recorded one by one, only those directly concerned take much notice. The grim, hard facts are that on only three of the Bureau of Reclamation's projects in the western United States, 92 men, women, and children have lost their lives. Most of them might still be living had they realized the ever-present danger of flowing water in irrigation canals. It is true that the accident rate on all the projects is not as high as on the three projects where the 92 tragedies occurred, but the danger exists and that is the important fact we must bear in mind.

Canal safety is our business whether we are th designers, builders, operators, irrigators, o dwellers on an irrigation project. We must se that the same water which is so necessary to ou existence does not become a menace threatenin the lives of the very ones who depend upon i We who design, build, operate, maintain, and liv near irrigation systems and their indispensabl canals, siphons, chutes, and other structures, ar aware of the inherent hazards in an irrigatio canal. Even so, we may become careless—an tragedy is often the result of our carelessness.

The general public, on the other hand, does no usually realize that the apparently peaceful an invitingly cool water can sweep a man severa hundred feet before he can catch his breath. An if he doesn't drown from the panic brought o when he finds that the water is too deep for him he may be swept suddenly into a siphon, over check, or through other irrigation structures.

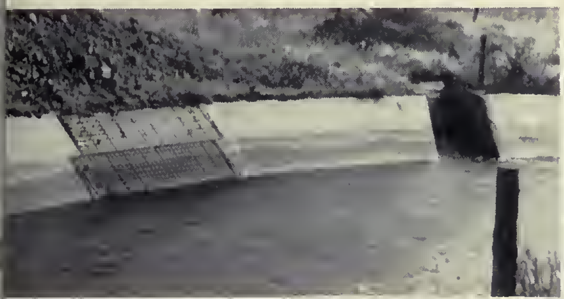


CLOSING IN ON THE CANALS. Above, a canal built in a once uninhabited area. Ever-expanding population and spreading farm and home developments call for protective measures. At left, a highway along the Provo Reservoir Canal, Deer Creek Division, Provo River project, Utah. Chain-link fencing with barbed-wire guard at top keeps vehicles from running into the canal, prevents access by the public, and protects domestic animals. *Both photos by R. W. Reitz, Region 4.*

Since canal safety is our business, it is the joint esponsibility of all of us to mind our business in everal ways. One way to protect the unwary is fence off hazardous reaches. Perhaps a more ffective way to caution the unknown is to pubcize through newspaper articles, radio broadasts, signs and posters, and movies the hazard of sing a canal as a recreational facility.

On many reclamation projects, both old and ew, plans are under way or being considered for he use of irrigation facilities for recreational urposes such as swimming and fishing and boating, and parks to entice people to safe areas and reduce the tendency of youngsters and adults to slip away to the canal for a "dip." Such facilities will afford new opportunities for hunters and fishermen to apply their skills and tend to eliminate accidents like the one which occurred recently when a fisherman, trying his luck in the deeper ponds of a sluiceway, was drowned in a sudden surge of released water.

The problem of making canals safe requires an individual study for each project. What must be done varies with the density of population, size



TEEL BARS DO NOT A PRISON MAKE—they are a means f escape from canals. Above, reinforcement bar mats and n escape ramp on the side slopes of the North Branch anal, Kittitas Division, Yakima project, Washington. At ight, handrails and escape ladders at the Jordan Narrows iphon of the Provo River project, Utah. *Photo above by . T. Larsen, Denver, Colo.; at right by R. W. Reitz, Region 4.*

of the canals, types and numbers of structures, and the terrain. Warning signs barring the public from these canals are not sufficient. Policing a large canal system to enforce the regulation is both practically and economically impossible. Cooperative effort by project management, water users, and civic and safety organizations to publicize unsafe practices relative to irrigation canals appears to be a better approach to the solution of canal safety.

Canal safety is being extended to embrace both domestic and wild animal protection. In some areas, remote from population centers, the yearly toll of domestic and wild animals is extremely high. An animal coming to drink from the canal often loses its footing and, being unable to gain firm footing to climb back to dry land, it is swept down the canal and drowned. Escape devices, both for animals and humans, are difficult to construct without interference to canal operation or debris removal. However, we are developing practical escape devices for both humans and animals.

Although a completely safe canal can probably never be built—there are always those who will deliberately disregard all warnings—safety measures which will materially reduce the number of accidental deaths can be built. With full cooperation from all, we can reduce the too numerous drownings which result from swimming, bathing, or fishing in reaches of canals or other waterways where such practices are hazardous. We can also design our structures to provide a maximum of protection for workmen and operators. Although we will not always know where a safety installation has saved a life, we do know now that there have been no accidents on many canals where safety measures have been installed. ###

Arizona 44 Cotton

(Continued from page 255)

seed, known as breeder's seed. The Departmen will at the same time supply the distributors wit approximately 1,000 pounds of parent seed grow from the breeder's seed of the previous year. Th distributors will select one or more growers wh will plant this seed and who will grow, under th supervision of the cotton breeder, parent an foundation fields. Registered seed thus produce will then be used for the production of certifie seed used for general planting. All seed from th general crop should go to the oil mill for crush ing. According to this plan the main crop shoul never be more than 5 years away from selfed seed

This plan should forestall a reoccurrence of th unfortunate situation which arose in 1951 whe the demand for Arizona 44 seed was so great tha some fields were planted with seed not eligible fo certification because of a lack of proper isolatio As a result there were hybrids between Arizon 44 and American Egyptian, which detracted great deal from the appearance of our fields, an which may have injured the spinning quality o 44 to some extent.

In conclusion, we believe Arizona 44 has take irrigated cotton out of the "penalty" class, int the "premium" class, proving that high qualit as well as high quantity crops can be grown unde irrigation. ###

Plans Released on Santa Maria Basin

Bureau of Reclamation plans for constructin the 184-foot-high Vaquero Dam and 214,000 acre foot storage reservoir on the Cayuma River, miles from the city of Santa Maria, Calif., an Corps of Engineers' plans for installing levee and channel improvements in the Santa Mari Valley have been incorporated in a planning re port and sent to Federal agencies and Californi State officials for review and comment prior t submittal to the President and the Congress.

The $24,575,000 project, of which $14,300,00 would be for Vaquero dam and reservoir an $10,275,000 for the levee and channel improve ment work, would replenish a dwindling under ground water supply and provide flood protectio for life and property in the Santa Maria Basin 130 miles northwest of Los Angeles and 60 mile northwest of Santa Barbara in southern Cal fornia. Water users would repay the Federa Government $10,770,000 of the dam and reservoi

›st. The remainder of the project expenditure 'ould be allocated to flood control benefits, for hich no reimbursement is provided under Fed-'al Law.

Authorizing legislation and appropriations ust be provided by the Congress before the pro-'am can be put into effect.

HOW DO YOU DO IT?

Did you ever have a weed control, ditch clean-g, and other operation or maintenance problem ıd not a single piece of equipment to do the job ıst right? And did you wish that you knew meone who had had a similar problem who had eveloped a machine or gadget that did the trick? id you finally have to build the equipment in your roject shop, and it took several seasons of opera-on before all the "bugs" were worked out? Then ıu are just the person we are looking for.

The Bureau of Reclamation is going to publish me booklets with descriptions, photographs, and rawings of equipment, attachments and tools hich have been developed in irrigation district ıops, by mechanically minded employees, to solve me of the many problems that plague irrigation ojects. Weed control, ditch cleaning and other peration and maintenance equipment will be in-luded. We know there are many ingenious de-ices which also would help the irrigation farmers.

How did you solve your problems? We want our suggestions for these booklets. The first one ill be on weed-control equipment. As we want o make it available as soon as possible, we would ppreciate receiving your suggestions by Decem-er 15. Anyone connected with any irrigation roject, either private or Federal, is invited to end in a description of an irrigation device, tell-ng how it is built and how it works. A photo-raph or drawing, or both, should also be included o that another shop would be able to build one ike it. It doesn't have to be a major piece of quipment. Often, special tools, gadgets, or at-achments are the biggest time, labor, and expense-aving devices. Anyone sending in an idea will e placed on a special mailing list to receive a opy of the first edition of the weed-control ooklet.

It is planned to punch the sheets so they can e placed in a standard 3-ring looseleaf binder. Then as we obtain new developments and ideas hey will be printed for filing in your binder with he others. Be sure and get your weed control equipment suggestions in by December 15, if possi-ble. You can send your ideas on other equipment now also if you wish. Send them to the Commis-sioner, Bureau of Reclamation, Washington 25, D. C., attention code 420.

Second Barrel of San Diego Aqueduct under Construction

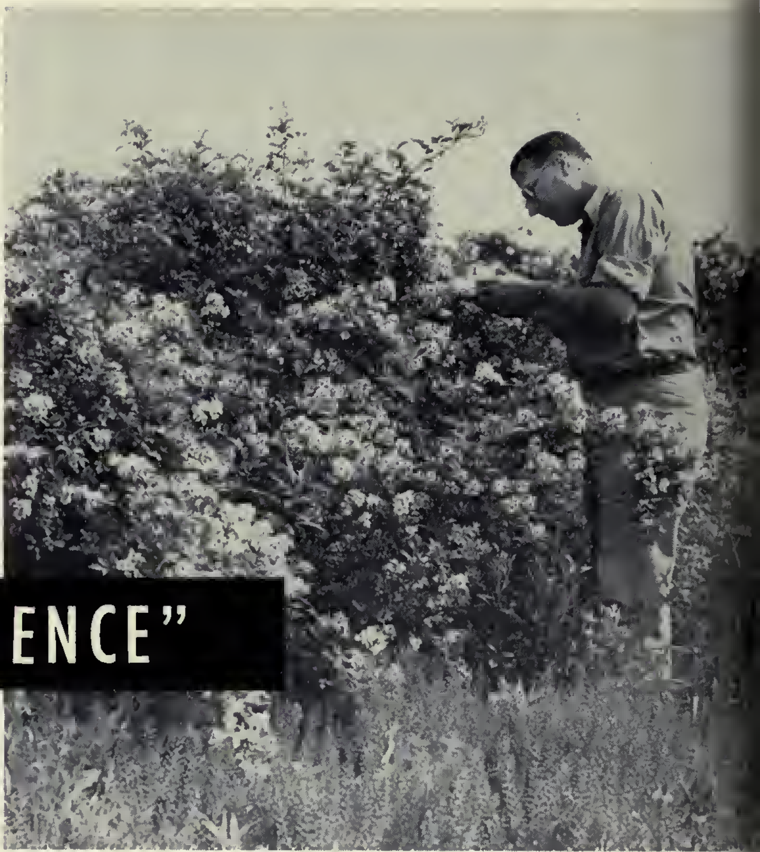
Three contracts were awarded in September for the 31-mile, Hamet to Rainbow, Calif., stretch of the 71-mile second barrel of the San Diego aque-duct being built under an agreement between the Departments of the Interior and Navy which pro-vides that the Bureau of Reclamation shall under-take the design and construction and administra-tion of the work with funds advanced by the Navy.

Charles S. Hale, Bureau of Reclamation engi-neer who was in charge of building the 123-mile Coachella branch of the All-American Canal sys-tem, and an underground concrete pipe irrigation system in the Coachella Valley, is acting project engineer on the San Diego aqueduct project.

For announcement of successful bidders on the first three contracts, and description of the work which must be completed in 2 years, see notes for contractors on page 276 this issue.

The second barrel, paralleling the first, will start at the equalizing reservoir near the western outlet of the San Jacinto Tunnel of the Metropoli-tan Water District of Southern California's Colo-rado River aqueduct, and extend southward 71 miles to empty into the San Vicente reservoir. Present plans call for completing the job in 3½ years.

MULTIPURPOSE PLANT—"MULTIFLORA ROSE" furnishes wildlife shelter, helps control erosion, makes a good windbreak, and keeps livestock in bounds. Conservative estimates indicate birds will nest every 40 feet. *Photo courtesy of the Soil Conservation Service.*



A "LIVING FENCE"

by DEREK D. EARP, Acquisition Biologist, State of Washington, Department of Game, Seattle, Wash.[1]

WITHIN THE NEXT 10 YEARS, the Columbia Basin in the State of Washington will come into its own, not only as an agricultural center but as a happy hunting ground for upland game birds.

Only the sage grouse and the sharp-tailed grouse inhabited the region before white men made their appearance in the basin. Unfortunately, these two fine birds cannot withstand competition with man, his farming methods, and grazing by domestic livestock, and only a few scattered flocks persist in the more remote areas. From a game management viewpoint they will never again be an important hunter's bird.

With the advent of irrigation, however, the Chinese or ring-necked pheasant have been established in the project area. Unlike the sage grouse and the sharp-tailed grouse, the Chinese pheasant not only persists but thrives in the company of man and diversified farming.

To produce an abundance of food and cover for upland game birds, the State of Washington, Department of Game, in cooperation with the Bureau of Reclamation, is creating bird habitat areas ranging in size from 10 to 360 acres, planting a variety of shrubs and food plants in which the Chinese pheasant, Hungarian partridge, and California quail can live and thrive.

At the same time, and to supplement the habitat areas, the Department of Game offered free multiflora rose plantings to the basin settlers and established farmers last year.

Multiflora rose is a hardy shrub of Asiatic origin and is used extensively in windbreak and erosion control plantings. In many ways it will benefit the landowner who plants it on his property. Its foremost use is that of a "living fence" which is inexpensive to install and economical to maintain. Within 3 to 6 years after planting it forms a hedge 8 to 10 feet high and about as wide. Its dense growth and sharp thorns will turn all domestic stock except poultry. Other benefits the landowner may receive from this plant are as follows:

1. It can be planted on contours where conventional fences are difficult to construct.

2. It provides homes for many beneficial birds

[1] We regret to announce that Mr. Earp died of cancer in a Seattle, Wash., hospital on April 15, 1952. His home was in Okanogan County, and he worked for the Washington Department of Game almost up to the last, although he had been suffering for some time, having spent much time in hospitals. The RECLAMATION ERA sends its deep sympathy to his mother and two brothers.

d insects, and will shade out weeds and other wanted shrubs.

3. When planted along property lines it elimi-tes intrusion by unwanted persons.

4. It does not sap surrounding fields like ordi-ry brush. Crops can be planted up to the very ge of the hedge without loss of production.

5. It will aid in the control of wind erosion and ifting snow.

6. Acting as a windbreak, it will reduce the loss irrigation water by evaporation.

Multiflora rose is not difficult to plant. It is eferable if the land to be planted is prepared in e fall, by plowing and discing thoroughly. anting should be done in the spring.

Planting can be done in several ways. When ly a few plants are to be put in, a shovel or mat-ck can be used to good advantage. Plowing is ster. With a two-bottom plow, operated at a w speed, an additional man can walk behind e forward slice and place the plants against the tside of the furrow just ahead of the rear share ich in turn covers the roots of the plant. With single-bottom plow, after one furrow has been ade, the plants can be laid in the ground and a cond run with the plow will cover them. The ants can be firmly set either by stamping them wn with the feet or by running a wheel of the actor down the plant row. During the plant-g operation the roots should always be kept oist. In single row plantings the plants are aced 18 inches apart and in multiple row plant-g they are spaced 36 inches apart and staggered.

In the Columbia Basin, irrigation is necessary multiflora rose is to survive and mature. Too much irrigation, however, can be as detrimental to the plant as no irrigation at all.

In order to obtain maximum growth the young plants should be cultivated for at least 2 years. Any good spring tooth or fixed blade type culti-vator may be used. An application of a complete fertilizer will also aid the plants in becoming established.

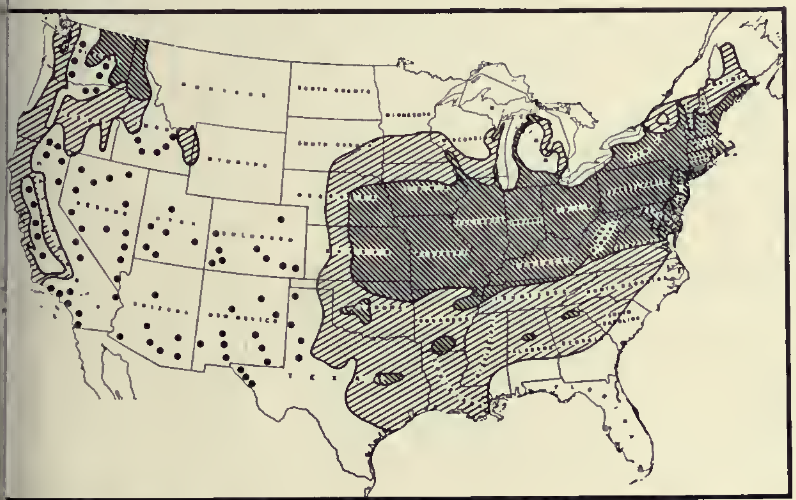
To receive free multiflora rose planting stock from the Department of Game the landowner must meet certain requirements.

1. He must have been farming at least 20 acres.
2. The land must be under an adequate irriga-tion system.
3. The plants must be cultivated, irrigated, and cared for until they become well established.
4. Livestock should not be permitted to browse upon the young plants.

Irrigation farmers in the State of Washington who are interested in making rose planting on their property can make application for free planting stock by writing directly to the Depart-ment of Game, 509 Fairview Avenue, North Se-attle, Wash., or by contacting their local game pro-tector. In order to receive planting stock for next spring, applications must reach the office by December 1, 1952.

Planting stock is also available free for wild-life habitat sites in South Dakota from the State Game, Fish, and Parks Department. In some of the other States in the reclamation area, free planting stock may be obtained in some instances from the Soil Conservation Service. In Nevada, multiflora rose plants are available under provi-

(Please turn to page 268)



WHERE MULTIFLORA ROSE GROWS

• Localities where it can probably be used with success on irrigated lands.

Area in which multiflora is known to be adapted for use. In the northern fringe of this zone, tops will be killed back in occasional severe winters but will not seriously hurt plantings.

Area in which multiflora is probably adapted for use but where it has not yet been adequately tested. *Map and data, courtesy, Soil Conservation Service.*

PETER P. VALLERY—

"Messiah" of Belle Fourche

The late Peter P. Vallery, who homesteaded in the Belle Fourche River valley about 10 miles below the City of Belle Fourche, S. Dak., in 1880, is credited with being the chief "messiah" for the establishment of the Belle Fourche irrigation project.

It is said of Mr. Vallery by old-timers that he was so enthusiastic about irrigation that he was irrigating plots of sugar beets on his ranch before most people even dreamed of an irrigation development in South Dakota. He did this with water he got from artesian wells—among the first in Butte County. He also pumped water for irrigation from the Belle Fourche River.

Along about the turn of the century Mr. Vallery had enlisted several other men in his crusade for irrigation, among them Alonson Giles, a Belle Fourche hardware dealer and owner of a 20,000-acre ranch where the project is now located.

Using a carpenter's level and a home-made tripod, Vallery and Giles located the diversion canal and hatched the original idea for a storage reservoir to irrigate about 8,000 acres under what is now the South Canal. At this juncture, they, and others, interested the late Congressman E. W. Martin of South Dakota's third district, in their irrigation plan.

Representative Martin presented the necessary facts in Washington, D. C., and soon the Reclamation Service was on the job with more refine surveying tools and water control know-how. I April 1904 the reclamation engineers recom mended that 60,000 acres of land be investigate for irrigation in the valley of the Belle Fourch River. The Secretary of Interior approved th project in May 1904 and set aside $2,100,000 c reclamation funds for its construction. Constru tion was begun in 1905 and water was brought t the first land in 1908. Thus came to a realizatio Peter P. Vallery's long-cherished dream.

Mr. Vallery, "daddy" of Belle Fourche irriga tion, was born in 1866 and went to South Dakota Black Hills from Plattsmouth, Nebr., in 1876 du ing the excitement caused by the discovery o gold in the hills. Like many other persons th caught up in the gold rush to the Black Hill Vallery decided that ranching and farming, fro a long-range standpoint, offered more returns th gold mining. Vallery died in 1937, but he h a son, Philip Vallery, who is carrying on as friend of Reclamation. He lives on the old Va lery irrigated farm.

Mr. Giles, whose land holdings have chang hands several times and are now, or part of the owned by William Olson, was born in 1853. H sold his Belle Fourche hardware store in 19 to Sam G. Mortimer and in 1917 left South Dako for California where he died in August 1921.

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ACRES OF ONIONS on Bill Hattori's field near Moses Lake, Wash. Some of the onion harvest was contracted for shipment to Chicago, like many of the other Columbia Basin project crops. *Photo by Harold Foss, Region 1 photographer.*

COLUMBIA BASIN'S FIRST HARVEST

Columbia Basin project's first harvest has been reaped. Farmers who irrigated the first fields in the State of Washington with water pumped from the Columbia River at Grand Coulee Dam are busy consolidating their gains or assessing their losses.

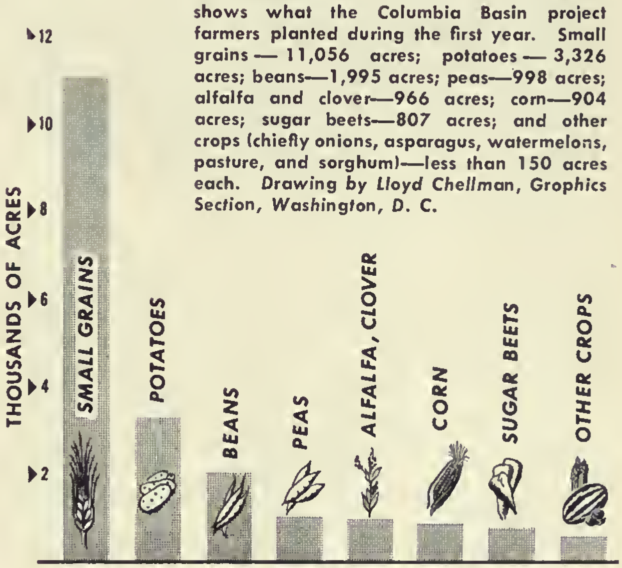
While all the columns are not totaled, the Columbia Basin farmers can be proud of their achievement, which dollarwise includes $1,000-an-acre potatoes at Moses Lake and $600-an-acre onions at Quincy. As for production on irrigated Columbia Basin project lands, farmers in the Moses Lake area raised an average of 15 tons of potatoes an acre, some growers reaching a top production of 22 tons per acre. D. C. McLean, a local warehouse superintendent, and one of the seven nearby potato dealers, estimated that the early spuds were running about 70 percent "number ones." At Winchester, Harold Faw raised close to a ton and a half of seed peas per acre, and Percy Kelley raised the peak crop of 3 tons of peas per acre.

Carload shipments of potatoes, onions, and watermelons from Moses Lake in June, July, and August of 1952 are estimated to be almost double the 1951 figure for the same period—287 carloads in 1951 and 533 in 1952. No shipments at all were made from the Quincy area last year, and the figures for 1952 are conservatively estimated at 150 freight carlots.

Wise farm management typified many of the Columbia Basin project settlers. One or two settlers plowed their pea crops under. Earl Gregory of Quincy estimated each acre of his soil would gain at least 200 pounds of available nitrogen worth from $36 to $60, with the green manure benefiting his sweet corn planting later.

Paul A. Kelly at Winchester planted Kenland red clover for certified seed, along with his peas. After the peas were harvested, the clover crop

THE FIRST LOOK AT THE FIRST CROPS shows what the Columbia Basin project farmers planted during the first year. Small grains — 11,056 acres; potatoes — 3,326 acres; beans—1,995 acres; peas—998 acres; alfalfa and clover—966 acres; corn—904 acres; sugar beets—807 acres; and other crops (chiefly onions, asparagus, watermelons, pasture, and sorghum)—less than 150 acres each. *Drawing by Lloyd Chellman, Graphics Section, Washington, D. C.*



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came out, giving him a second harvest this year. He lined his field with beehives to pollinate the growth.

Many of the farmers are starting to build up their livestock or beef cattle and pastures to combine irrigation farming with dairy operations.

Where did the fruits of the fields go? Some crops were trucked to Yakima, Wenatchee, or other nearby towns, where warehouses and processing plants were ready to receive basin products. A Wenatchee dealer contracted for about 700 acres of green peas, which were deep frozen and will appear in grocery stores all over the country. Others were shipped to Chicago, Ill., for use in one of the nation's leading food processing concerns where they will later appear as split-pea soup. And of course, the famed "Idaho" potatoes were sacked, stored and prepared for shipment all over the country. I. Tanaka near Moses Lake markets some of his watermelons at a highway fruit stand and exports others to Canada.

The Columbia Basin farmers on this first 59,558 acres had their work cut out for them. Traditionally, the first year on new land does not produce a bumper harvest, and at the present time it is not known what the final figures on yields will show. Irrigation water was available to 925 farms; more than 400 actually used water for land preparation, preirrigation and other purposes, and crops were grown on about 385. This resulted in the cropping of an estimated 20,870 acres—about as expected for the first year.

The new settlers faced a tremendous responsibility and considerable investment as they moved onto sagebrush land, cleared it, put up homes, purchased adequate but expensive sprinkler systems or leveled the land, then planted the soil. handled the water, and completed the cycle by the frequently costly, but usually profitable, job of harvesting the crops.

Some of the richest (and most "blowy") lands, particularly in the Winchester-Quincy area, had to be reseeded several times due to wind sweeping across the raw fields. One farmer is reported to have seeded part of his farm four times.

Bob Maurer, southwest of Ephrata, had to irrigate 24 hours, around the clock, and move his

"THIS FRUITFUL EARTH"

ALF OF THE MILLION ACRES of the Co- ia Basin project, when fully developed, be used to raise dairy or beef cattle, ac- ing to the experts. Here is a good start ne Winchester Development Farm.

nd 3. TEN-MONTH TRANSFORMATION. er A. Peters' farm near Moses Lake. o 2 as it looked September 21, 1951. o 3 on July 25, 1952, with wheat field, road and power lines, and permanent e replacing tarpaper shack where Peters, vy veteran, and his wife lived when they moved in.

HREE TONS OF PEAS AN ACRE were d on P. A. Kelly's ranch. Average har- for approximately 700 acres on the proj- vas a ton and one-half per acre.

SSEMBLY LINE PRODUCTION as peas Kelly's field and others around his were n to vining machines near Winchester, helling, loading into lugs, and freighting osed trucks for quick freezing.

"I DID THAT ALL IN A MONTH." Paul N. olds from Idanha, Oreg., looks with justi- e pride at his 120-acre irrigation layout h he prepared between March and April year. The field in the right center is used drainage. Reynolds sprinkler irrigated e, but believes he should irrigate more n during the growing season. He has a e investment in underground and surface , and a pumping plant. Next year he s to raise alfalfa and red clover, and get od start on a dairying operation by pas- g a couple of heifers.

tos 1, 2, and 3 by Harold Foss; photos 4, nd 6 by Frank B. Pomeroy, both Region 1 tographers.

sprinklers every 4 hours to bring out his beans. "My sprinkler system was a little under-designed," he explained.

Deep leveling, in some cases, cut down the productivity of the soil, and will continue to do so until the necessary organic content is built up.

Some farmers did not get their crops in early enough the first year, or were unable to apply water for the first time as soon as it was desirable. The percent of problems encountered runs very high, but the percent of failures runs pretty low—only 2 percent of the plantings. This is considered pretty good for the first year, considering all the problems encountered by new people on new land.

Next spring, as many of these farmers enter their second year, water will be available for the first time to approximately 807 new farms, comprising 59,650 acres, and under a 7-year program, approximately a half million acres will be irrigated by the end of 1958.

The beehive of activity in the first year for irrigation was not limited to the farms. People moved into the entire project area, increasing the population 15 percent—from 35,000 to 39,000. Eventually it will be 150,000 or more.

Five new warehouses were erected on the project this year (two at Moses Lake, and one each at Wheeler, Winchester, and Quincy) mainly to process beans and potatoes.

This year most of the sugar beets were sent by rail to Toppenish, but the Utah-Idaho Sugar Beet Co. broke ground in June for a new $9,000,000 refinery at Wheeler which is scheduled to be operating next fall. Amalgamated Sugar Co. announced plans to develop a site for a sugar beet plant 5 miles south of Quincy.

A 191-mile $2,000,000 network of new roads was built in three counties on the project in 1952. This program will continue each year of the 7-year program, moving into new land that is irrigated for the first time. The goal is to provide a road to serve every new farm, preferably in the first year the water is received.

Three new banks were organized in the project this past year. Property in Grant, Adams, and Franklin Counties reached a value of $4,700,000 representing a 9-percent increase in assessed valuation from 1951 to 1952.

In the Moses Lake school district where only 8 school teachers were needed in 1942, this year 92 teachers were educating the younger generation.

A tractor manufacturing firm announced plans to move its headquarters to Ephrata. The company will employ 150 persons.

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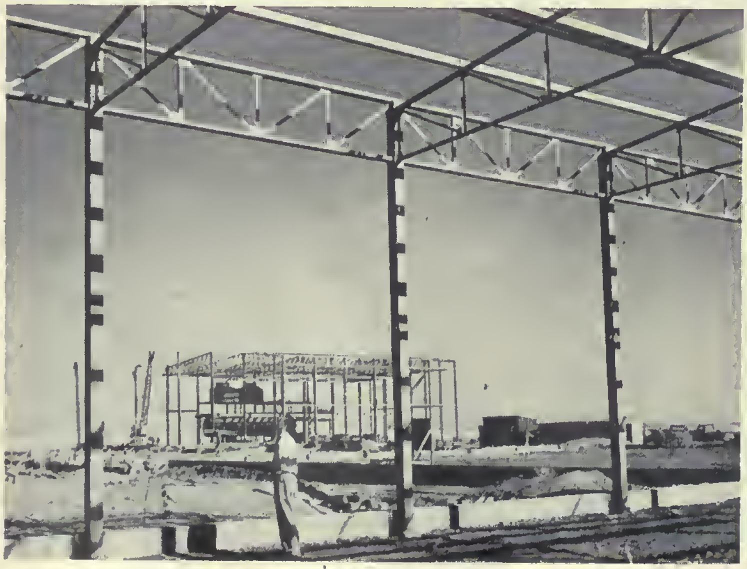


FUTURE CROPS of sugar beets grown on the Columbia Basin project will be processed in these structures being built by the Utah and Idaho Sugar Company at Wheeler which has invested $9,000,000 in the plant. The steel superstructure in the foreground will be the sack-storing wing, eventually to be joined with the steel frame in the background. *Both photos by F. B. Pomeroy, Region 1.*

"I COULDN'T STAY AWAY," says Charles A. Faw, who came from semiretirement to farm on the Columbia Basin near Winchester. Not easily discouraged, he reseeded his 10-acre patch of onions, contracted for at $32.50 per ton and reportedly worth $600 an acre. He hears they do better the second year in the same field. Here he proudly shows off his 25 acres of red Mexican beans.

IRRIGATION PAYS, according to Altus farmers Frank Hafner (at right) and Brooks Lagree (below). *Photo at right, courtesy of the Geary Star; below by Fred S. Finch, Region 5 photographer.*

ALTUS FARMERS SPEAK UP

y U. H. WARNER
ditor, The Geary Star, Geary, klahoma

PART 2— LAGREE and HAFNER

In this series of interviews with successful irrigation armers of the W. C. Austin project in southwestern)klahoma, Mr. Warner, publisher and editor of the Geary Star, a weekly newspaper published at Geary, Okla., and resident of the Geary Chamber of Commerce, tells how rrigation benefits both the irrigation farmer and the urrounding community.

Mr. Warner started publishing this series in the Geary Star under the title, "Irrigation in Oklahoma," due to his nterest in the proposed Canton irrigation project in the North Canadian River Basin in west-central Oklahoma, ow under study by the Bureau of Reclamation. The Canton irrigation district, embracing lands of the proposed project area (providing for the irrigation of about 6,000 acres of fertile alluvial lands) was organized in 945 under the Oklahoma Statutes by a vote of a substanial majority of the qualified land owners.

CASTOR BEANS, ALFALFA, AND COTTON, all have been paying crops for Brooks Lagree, Altus, who never had done any irrigating before water came down the ditches from Altus Lake 4 years ago.

Lagree sat in his easy chair in his fine brick home at 917 Commerce Street and told us of his irrigation experience while his servant put the finishing touches to dinner preparations, and his daughter, 7 years old, finished her daily piano practice.

"The big thing about irrigation" said Lagree, "is the satisfaction of knowing after you plant a crop that you can have water on it when it needs water. I farmed dry land for 20 years before we got irrigation.

"I ran water on my alfalfa field last month and if this freeze (it was 24 degrees at Altus the day we visited him) doesn't kill it, I will cut my first crop of hay by April 1."

Lagree raised 11 acres of castor beans last year as a test. They made a gross return of $161 per acre and after he figured out all expense for seed, planting, water, and combining he had a net profit of $128 per acre. He is going to plant 30 acres in 1952 and has a new variety which he thinks will not shatter as much as the strain he used in 1951.

Harvesting is no problem, Lagree said, as he bought a new combine last fall which did a perfect job of taking the beans out of the field. Not one pound was pulled by hand. He said there was some labor problem on castor beans until last year. Laborers have found now that they can make more money pulling beans than they can at snapping cotton.

The castor beans take a lot of water and Lagree has his eye on another crop, soy beans. He watered the castors five times and had 30 acres of soys which he watered only one time. They survived two hail storms which cut the stand by one-half and still came through with 28 bushels per acre.

After the cotton wilts under summer heat, soy beans are still green, said Lagree. They make a great green manure crop. Even if one only got his seed back at harvest time they would be a valuable crop.

Lagree said Boyd McMahan is another Altus farmer who believes in castor beans. McMahan harvested 160 acres in 1951 with a greater cash return than he got from his cotton. Among other advantages, the beans are free from insect pests.

Likes To Break Crop Records

"Give me a few more years and I am going to show you that I can raise three bales of cotton per acre right here in Oklahoma," declares Frank Hafner, Altus farmer.

Hafner's is no idle boast for his record of Irish potato production will be hard to believe even after we set down the facts which the Reclamation Bureau gave to us and which Hafner verified when we visited him on March 21.

Hafner was lying flat on the ground on his back tightening some bolts on the front end of a Chattin ditcher when we stopped our car at his farm seven miles southwest of Altus. He did not have time to talk so we snapped his picture when he stood up to fasten the ditcher to a tractor with a log chain. We made a date with him to visit for a while at 7 p. m., after the borders had been plowed.

When Hafner plows and cultivates his land to get ready for a crop, he turns the machinery on the old borders. He says he can make a new one, half a mile long in an hour or two with the Chattin so he does not bother to save the old ones from year to year.

Hafner grew up in Idaho and learned how to irrigate 30 years ago.

We were ushered into the kitchen of the spacious new and modern home on the Hafner farm that evening. Mrs. Hafner sat at the kitchen table and wrote a letter but she kept one ear on the conversation as her husband related his story of irrigation. She was able several times to fill in dates and figures as the potato story unfolded.

The Hafners irrigated for 5 years out of wells at Hereford, Tex., before they decided to move to Oklahoma to try the new irrigation area at Altus.

They chose a quarter section and took an option to buy with a contract to pay $9,000 cash rent for 2 years.

They planted 150 acres of potatoes in 1950 and raised 500 sacks of No. 1 potatoes to the acre. Those sold at $3 per hundred pounds, or $1,500 return per acre. Their 1951 crop again averaged 500 sacks to the acre. They bought the land. He has turned down a recent offer of $750 per acre for his farm.

Hafner did all the work of producing the first crop himself. He now hires three men full time as he raised 150 acres of cotton last year along with the potatoes. The cotton made a bale per acre but there was much expense because of heavy infestation of boll worm.

"This is better land and better climate than I saw in Idaho or in Texas," said Hafner, "and I am sure that after I get going good on cotton I can raise three bales per acre just like they do in Arizona under irrigation.

"I planted cotton on my potato ground last summer after the potatoes were harvested. I got it in the ground on July 19 and still made an average yield of three-fourths of a bale per acre."

We took another look at Hafner's potato record and at the gleam in his eye and promised to go back down to Altus to write up the story when this energetic irrigation farmer gets his three bales per acre.

(Next Month—Interviews with Southall and Kelley)

"A Living Fence"

(Continued from page 261)

sions of the Clarke-McNary Act from the Extension Forester of Nevada at $3 a hundred for bare-root stock, 4 to 8 inches high. In the southwest or south central States osage-orange (maclura pomifera) is preferred, due to the fact that multiflora rose is not alkali tolerant.

In Nebraska, on the Frenchman-Cambridge Division of the Missouri River Basin project, the Bureau of Reclamation and the Fish and Wildlife Service are considering establishing a test planting of multiflora rose to determine its value in that area for erosion control and wildlife habitat.

Like any other "plant out of place," if multiflora rose spreads beyond its intended boundaries, it becomes a "weed" and a menace. It also has thorns. For more detailed information, we refer the reader to the following articles in the Journal of Wildlife Management, "Spreading Tendencies of Multiflora Rose in the Southeast," in the July 1950 issue, volume 14, number 3, and "Multiflora Rose as a Cover for Quail" in the April 1951 issue, volume 15, number 2. ###

WATER REPORT

WHEN THE SNOW MELTS, how much water will run to the streams and fill the reservoirs? Snow surveyors find out by carefully weighing the hollow aluminum tube with its core of snow on specially calibrated scales. *Photo by Robert Branstead, courtesy of the Soil Conservation Service, United States Department of Agriculture.*

R. A. WORK, Senior Irrigation Engineer, and
YDE R. HOUSTON, Irrigation Engineer, both of the Soil
nservation Service, United States Department of Agriculture

WE'VE BEEN HEARING SOME RECENT TALK about ying rivers. History describes rivers that have ed. The civilizations supported by these wars likewise withered. It is not always clear to hat extent such changes over very long time eriods (hundreds of years) were due to slowly anging climate or were chargeable to mankind's ouse of watersheds. Either or both might have en the case. Granted that rivers can die and ve died in the past, is it inevitable that the vers we know today should go the same way? he writers feel sure this will not occur since cometent conservationists, engineers and foresters e continually seeking means to prolong the life nd conserve or expand the water productivity f our Nation's watersheds. One proven means of rolonging streamflow in the West is by storing rplus waters in reservoirs as an insurance ainst future shortages.

1952 proved to be one of those seasons which underscores the preeminent value of reservoired water supplies. As pointed out in the WATER REPORT for April 1952, the West-wide mountain snow crop then measured, showed promise of the greatest streamflow of many years in most Western States.[1]

This promise was generally realized, but later in the summer, because of extremely dry weather, extended for months, reservoired supplies provided the back-log that broke the back of the western summer drought. In many areas the natural run-off was so great that reservoired water

[1] The Division of Irrigation and Water Conservation is the Federal coordinating agency of snow surveys conducted by its staff and many cooperators, including the Bureau of Reclamation, other Federal bureaus, various departments of the several States, irrigation districts, and private agencies. The California State Division of Water Resources, which conducts the snow surveys in that State, contributed the California figures appearing in this article.

supplies proved far in excess of water needs during the summer period of greatest need. Thus in many reservoirs, a greater than usual "hold-over" supply of water remains. In California, for instance, the reservoir "hold-over" is the greatest recorded for October first.

No one can now foretell the amount of snow-water that will be stored during the coming winter, but the substantial water supply now held in reservoirs of Western States at least presages well for the 1953 irrigation season.

The following State by State inventory gives a more detailed accounting by States of reservoir hold-over and other facts pertinent to water supply outlook for 1953, so far as it can now be measured.

ARIZONA—With the exception of irrigated areas along the Upper Gila River, Arizona is entering the coming winter months with a good water supply outlook.

The lands irrigated from flow of the Salt and Verde Rivers had plenty of water all season. The reservoirs on the Salt and Verde Rivers now store close to 1.5 million acre-feet of water, or to about 65 percent capacity. Carl Pleasant Dam on the Agua Fria now stores water to 52 percent of capacity. The Maricopa Water Conservation District, supplied from this reservoir, had sufficient water all season.

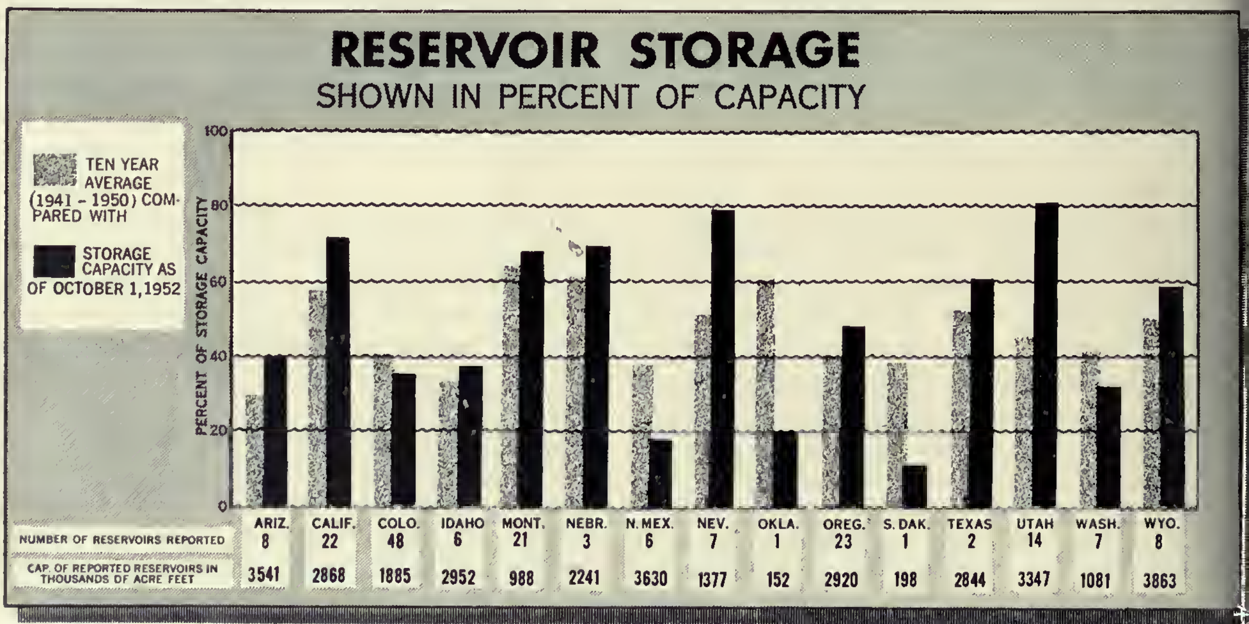
San Carlos Reservoir on the Gila River now contai practically no usable storage. The Irrigation Distri was able to supply only about 70 percent of the wate demanded during 1952.

CALIFORNIA—As the beginning of the snow seaso approaches, California has in storage, in major Sierr Nevada reservoirs, the greatest supply of water on recor for October 1. The 25 reservoirs serving the Sacrament and San Joaquin held 5,691,800 acre-feet on October 1952, or 72 percent of capacity, as compared with 4,380,2 acre-feet and 55 percent of capacity on October 1, 195 The 1952 storage is 123 percent of the past 10-year norma

COLORADO—Water stored in 48 Colorado reservoi is 5 percent below average.

The water supply on the South Platte Drainage wa above normal for this season. However, due to a dr summer, demand for irrigation water was much abov average. Water was therefore sold by the Norther Colorado Conservancy District (Colorado-Big Thompso

Watershed	Number of reservoirs	Capacity (acre-feet)	Water stored Oct. 1	
			1951 (acre-feet)	1952 (acre-feet
Sacramento	1	4, 500, 000	2, 557, 300	3, 431,
Feather	4	826, 800	624, 580	659, 4
Yuba	3	244, 800	136, 260	159, 1
Bear	1	7, 200	2, 190	1, 6
American	2	30, 200	16, 260	25, 1
Mokelumne	2	349, 000	271, 120	300, 5
Stanislaus	3	145, 500	25, 430	41, 6
Tuolumne	3	676, 800	373, 860	518, 3
Merced	1	281, 000	17, 270	116, 4
San Joaquin	5	854, 400	355, 990	437, 9
Total	25	7, 915, 700	4, 380, 260	5, 691, 8



Most State averages are for full 10-year period, but in a few cases reservoirs having shorter records are included. CALIFORNIA—does not include Millerton or Shasta Reservoirs. October 1 storage in these two reservoirs combined was 3,620,1 acre-feet, or 72 percent of capacity. COLORADO—does not include John Martin reservoir. On October 1 this reservoir was empt MONTANA—does not include Fort Peck Reservoir. October 1 storage was 13,860,000 acre-feet or 73 percent of capacity. Does n include Flathead Lake in which October 1 storage was 1,620,000 acre-feet or 91 percent of capacity. NEVADA—does not include La Mead. October 1 storage was 22,543,000 acre-feet or 83 percent of capacity. WASHINGTON—does not include Franklin D. Roosev Lake. October 1 storage was 5,184,000 acre-feet or 99 percent of capacity. WYOMING—does not include Boysen reservoir wi capacity of 820,000 acre-feet and September 30 storage of 647,800 acre-feet.

oject) in late season, thus avoiding a slight shortage. iis was not expected as of April 1952.

Reservoirs on the Colorado-Big Thompson project on th sides of the Continental Divide could have filled this ar if power operations had allowed. Granby Reservoir almost full, 2 to 3 years ahead of expectations.

On the other hand, storage in the small farm irrigation servoirs over the South Platte Valley is now below rmal and less than last year. Should snow accumulan this season be less than normal, the 1953 water supy will be deficient, probably placing demands for water the Colorado-Big Thompson project. Soil moisture nditions on mountain watersheds are fair to poor.

Summer flow of the Arkansas River was above normal, t the irrigation water supply in some areas was defient. This was due to limited carry-over reservoir store from last year and unusually heavy irrigation deand. Except for a few reservoirs in the mountains rved by transmountain diversions, most reservoirs are w practically empty, including John Martin. If snow cumulation next season is normal or less, water shorte may be expected along the Arkansas in 1953.

Although the summer flow of the Rio Grande and its ibutaries in Colorado was not as high as expected, it as much above normal. The water supply in the San uis Valley was much improved over that of the past 2 ars. Ground-water levels have been raised. Carryer storage is approximately normal. A very satisctory crop year has been reported for the San Luis alley.

IDAHO—Reservoirs in Idaho store water in volume percent above the 10-year average. In view of the unsually heavy demand this summer for irrigation water, e to the driest summer in many years, such a favorle hold-over would not exist had it not been for unusuly heavy spring run-off.

In practically all cases, the heavy river flows which ere forecast last spring by the snow surveys later marialized. Considerable damage to property and farm nd occurred. The town of Carey, Idaho, was saved om destruction only by prompt and effective emergency easures. The channel of Little Wood River is now so oked by debris that even average river flow next spring uld be damaging unless the channel is cleared.

MONTANA—Reservoir storage on the first of October slightly below average and is not as good as 1951. torage in power reservoirs is greater than average in nticipation of a short natural run-off during the late fall nd early winter. These plants are mostly run-of-theiver operation and use storage only when shortages ccur.

NEVADA—The reservoir storage picture in Nevada is specially bright this year. At the beginning of this inter's snow season, the available storage is about 80 ercent of capacity and 150 percent of the past 10-year verage.

NEW MEXICO—Storage in Elephant Butte and Caallo Reservoirs combined is now about 370,000 acre-feet. he water supply outlook for next year is improved over a ear ago, but normal or above normal flows must be obined next year to maintain or improve this position.

October 1 storage in six reservoirs in New Mexico is 7 percent of capacity, whereas the 10-year average is 37

Reservoir	Capacity acre-feet	Active storage October 1	
		1952 (acre-feet)	1941–50 average (acre-feet)
Vildhorse	32, 690	19, 514	12, 005
ye Patch	179, 000	146, 000	103, 174
ridgeport	42, 455	29, 704	14, 878
opaz	59, 440	34, 779	18, 661
ahonton	290, 900	195, 325	137, 443
ahoe	732, 000	634, 800	407, 621
oca	40, 900	6, 300	23, 731

percent of capacity. Should a short snow year occur, there will be an extreme shortage of irrigation water in 1953.

The water supply on the Carlsbad project on the Pecos watershed was much below normal this year.

OREGON—October 1 storage in 22 of Oregon's reservoirs was 49 percent of capacity, while the past 10-year average was only 40 percent of capacity. In case of Upper Klamath Lake, present storage is the greatest recorded for October 1.

SOUTH DAKOTA—Storage in Belle Fourche Reservoir is only about one-fourth of normal for this date and is less than 20,000 acre-feet.

TEXAS—Storage in Buchanan and Marshall Ford Reservoirs is 61 percent of capacity, while the past 10-year average is only 54 percent.

UTAH—Reservoir hold-over storage is the best that it has been for many years, being 81 percent of capacity as of October 1, compared to the 10-year average of 44 percent.

Reservoir	Capacity (acre-feet)	Active storage October 1	
		1952 (acre-feet)	1941–50 average (acre-feet)
Bear Lake	1, 420, 000	1, 116, 800	766, 890
Deer Creek	147, 300	124, 300	73, 700
East Canyon	28, 730	12, 000	14, 750
Echo	73, 900	39, 660	20, 050
Hyrum	15, 310	8, 400	5, 090
Moon Lake	35, 760	18, 800	8, 480
Pineview	44, 175	13, 300	13, 865
Strawberry	270, 000	250, 300	68, 725
Utah Lake	850, 200	[1] 902, 000	343, 000
Otter Creek	52, 500	30, 000	23, 870
Piute	84, 750	25, 450	10, 700
Rocky Ford	23, 300	9, 930	9, 660
Sevier Bridge	236, 000	133, 800	101, 370
Scofield	65, 000	47, 800	8, 950
Total	3, 346, 925	2, 732, 540	1, 469, 100

[1] The level of Utah Lake is above what is known as compromise level, which has always been taken as capacity.

WASHINGTON—Reservoir storage as of October 1 is nearly 10 percent below average. This is explainable by the unusually heavy summer withdrawal of stored water.

The early temperate spring this year resulted in large volumes of water coming down the stream channels evenly and with little damage. The main stem of the Columbia began its annual rise earlier than usual and continued at a relatively high level through April, May and June. About 9,000,000 acre-feet of water was stored in Columbia Basin reservoirs during this 3-month period. This represents the greatest storage ever obtained in this Basin in that particular time period. The peak flow of the river was held below a damaging point through the skillfully managed water storage program.

WYOMING—The last 3 months of the summer season were characterized by deficient rainfall and heavy demands for irrigation water. In local areas not served by large storage systems, the carry-over storage is below average.

Accuracy of 1952 Run-off Forecasts

1952 forecasts of run-off generally spoke of flows ranging from well above normal to the greatest of record in some cases. Relatively few of the run-off records for the 260 gaging stations

Water Stored in Reclamation Reservoirs

Location	Project	Reservoir	Storage (in acre-feet)		
			Active capacity [1]	Sept. 30, 1951	Sept. 30, 195
Region 1	Baker	Thief Valley	17, 400	2, 500	1, 800
	Bitterroot	Lake Como	34, 700	7, 600	600
	Boise	Anderson Ranch	464, 200	344, 600	307, 100
		Arrowrock	286, 600	36, 100	29, 800
		Cascade	650, 000	15, 900	37, 200
		Deadwood	161, 900	0	65, 600
		Lake Lowell	169, 000	53, 200	50, 700
	Burnt River	Unity	24, 600	2, 600	2, 700
	Columbia Basin	Equalizing	1, 001, 000	0	338, 000
		F. D. Roosevelt	5, 220, 000	5, 220, 000	5, 184, 000
		Potholes	350, 000	0	40, 800
	Deschutes	Crane Prairie	50, 000	57, 000	50, 000
		Wickiup	182, 000	19, 000	2, 000
	Minidoka	American Falls	1, 700, 000	1, 021, 300	584, 700
		Jackson Lake	847, 000	622, 700	281, 700
		Lake Walcott	95, 200	94, 000	92, 200
		Grassy Lake	15, 200	12, 100	9, 400
		Island Park	127, 300	86, 400	62, 500
	Okanogan	Conconnully	13, 000	7, 500	5, 300
		Salmon Lake	10, 500	10, 200	10, 100
	Owyhee	Owyhee	715, 000	390, 700	74, 200
	Umatilla	Cold Springs	50, 000	400	0
		McKay	73, 800	13, 800	9, 500
	Vale	Agency Valley	60, 000	3, 000	6, 500
		Warm Springs	191, 000	5, 000	98, 200
	Yakima	Bumping Lake	33, 800	3, 000	4, 800
		Cle Elum	435, 700	159, 500	112, 200
		Kachess	239, 000	123, 800	93, 900
		Keechelus	153, 000	55, 000	62, 200
		Tieton	197, 000	80, 600	60, 200
Region 2	Central Valley	Millerton Lake	500, 000	125, 100	168, 200
		Shasta	4, 366, 800	2, 431, 400	3, 505, 500
	Klamath	Clear Lake	513, 300	66, 700	199, 700
		Gerber	94, 300	18, 200	41, 300
		Upper Klamath Lake	524, 800	214, 400	287, 700
	Orland	East Park	50, 600	10, 200	23, 400
		Stony Gorge	50, 000	3, 800	8, 900
Region 3	Boulder Canyon	Lake Mead	27, 207, 000	19, 118, 000	22, 543, 000
	Davis Dam	Lake Mohave	1, 809, 800	1, 373, 100	1, 589, 400
	Parker	Havasu	688, 000	600, 900	603, 100
	Salt River	Bartlett	179, 500	25, 000	53, 000
		Horse Mesa	245, 100	62, 000	229, 000
		Horseshoe	144, 000	7, 000	1, 000
		Mormon Flat	57, 900	18, 000	50, 000
		Roosevelt	1, 381, 600	87, 000	1, 012, 000
		Stewart Mountain	69, 800	38, 000	400
Region 4	Fruit Growers	Fruit Growers	4, 500	300	1, 600
	Humbolt	Rye Patch	179, 000	85, 300	146, 000
	Hyrum	Hyrum	15, 300	5, 600	8, 400
	Mancos	Jackson Gulch	9, 800	1, 000	5, 500
	Moon Lake	Moon Lake	35, 800	11, 900	18, 800
		Midview	5, 800	3, 700	4, 800
	Newlands	Lahontan	290, 900	110, 000	195, 300
		Lake Tahoe	732, 000	531, 600	634, 800
	Newton	Newton	5, 300	1, 500	2, 100
	Ogden River	Pine View	44, 200	13, 400	13, 300
	Pine River	Vallecito	126, 300	22, 400	61, 900
	Provo River	Deer Creek	149, 700	117, 700	124, 300
	Scofield	Scofield	65, 800	26, 700	47, 800
	Strawberry Valley	Strawberry	270, 000	132, 700	250, 3[illegible]
	Truckee River Storage	Boca	40, 900	27, 800	6, 300
	Uncompahgre	Taylor Park	106, 200	45, 500	77, 700
	Weber River	Echo	73, 900	38, 400	39, 600
Region 5	W. C. Austin	Altus	145, 000	100, 600	22, 400
	Balmorhea	Lower Parks	6, 000	100	300
	Carlsbad	Alamogordo	131, 900	13, 200	18, 500
		Avalon	6, 600	6, 000	1, 000
		McMillan	38, 700	1, 100	[illegible]
	Colorado River	Marshall Ford	810, 500	37, 100	737, 600
	Rio Grande	Caballo	345, 900	9, 600	10, 3[illegible]
		Elephant Butte	2, 197, 600	19, 400	361, 0[illegible]

Water Stored in Reclamation Reservoirs—Continued

Location	Project	Reservoir	Storage (in acre-feet) Active capacity [1]	Sept. 30, 1951	Sept. 30, 1952
egion 5	San Luis	Platoro	54, 000	0	0
	Tucumcari	Conchas	269, 100	135, 300	85, 500
egion 6	Belle Fourche	Belle Fourche	185, 200	44, 000	19, 200
	Milk River	Fresno	127, 200	94, 900	70, 100
		Nelson	68, 800	42, 500	40, 300
		Sherburne Lakes	66, 100	15, 600	5, 400
	Missouri River Basin	Angostura	92, 000	41, 000	69, 200
		Boysen	820, 000	0	647, 800
		Dickinson	13, 500	0	4, 600
		Heart Butte	68, 700	62, 700	69, 400
		Keyhole	270, 000	0	10, 500
		Shadehill	300, 000	0	79, 200
	Rapid Valley	Deerfield	15, 100	13, 800	12, 600
	Riverton	Bull Lake	155, 000	146, 600	88, 200
		Pilot Butte	31, 500	4, 200	6, 200
	Shoshone	Buffalo Bill	394, 600	389, 700	276, 000
	Sun River	Gibson	105, 000	70, 100	31, 300
		Pishkun	30, 100	24, 500	17, 200
		Willow Creek	32, 400	23, 600	18, 600
egion 7	Colorado-Big Thompson	Granby	467, 600	218, 600	432, 400
		Green Mountain	146, 900	132, 300	135, 500
		Horsetooth	151, 700	40, 800	49, 900
		Shadow Mountain	1, 800	1, 500	700
	Kendrick	Alcova	190, 300	162, 300	164, 700
		Seminoe	993, 200	908, 300	865, 700
	Mirage Flats	Box Butte	30, 600	17, 900	10, 000
	Missouri River Basin	Bonny	165, 000	21, 500	21, 500
		Cedar Bluff	131, 700	129, 200	73, 100
		Enders	36, 000	26, 500	19, 400
		Harry Strunk Lake	35, 000	33, 000	32, 200
	North Platte	Guernsey	44, 200	0	10, 000
		Lake Alice	11, 000	3, 000	300
		Lake Minatare	60, 800	21, 000	3, 100
		Pathfinder	1, 040, 500	371, 300	450, 900

[1] Available for irrigation.

t which forecasts were issued are now available. These few show rather good verification of the forecasts. Since historical records for high run-off were established for many watersheds, such close verification provides pleasing evidence of the ability of mountain snow surveys to interpret unusual conditions.

ARIZONA—The outcome of the Arizona forecasts in 1952 is shown below:

Stream	Obtained [1] (acre-feet)	Forecast for 1952 April 1 Acre-feet	April 1 Error, percent	May 1 Acre-feet	May 1 Error, percent
erde River, below Tangle Creek	[2] 167, 260	150, 000	10	160, 000	4
alt River, North Roosevelt	[3] 488, 000	500, 000	2	460, 000	6
ila River at Virden, plus San Francisco at Clifton	[2] 89, 790	100, 000	11		
olorado River near Grand Canyon	[4] 15, 200, 000	17, 200, 000	13	16, 000, 000	5

[1] Preliminary only, subject to revision; data of streamflow are provided by U. S. Geological Survey.
[2] April-May, inclusive.
[3] April-June, inclusive.
[4] April-September, inclusive.

CALIFORNIA—On April 1, it was forecast that the snowmelt run-off in 1952 would be the greatest since the California Cooperative Snow Survey program was initiated in 1930. Precipitation during April was less than half of normal on the watershed above Shasta Dam and on those of the Feather and Yuba Rivers. On the watersheds of the American, Mokelumne, Stanislaus, and Tuolumne, April precipitation ranged from about 60 to 100 percent of normal. On the watersheds of the Merced, Upper San Joaquin, Kings, and Kaweah Rivers, April precipitation was slightly above normal. The Kern River watershed at the southern end of the Sierra Nevada received only 75 percent of normal April precipitation. Nevertheless, the revised forecast on May 1 again anticipated a record amount of run-off.

Preliminary data now indicate that 24,428,000 acre-feet of run-off occurred on the 12 major rivers of the Sierra Nevada during the months of April through July 1952. This total run-off exceeded the previous maximum, following 1930, by 500,000 acre feet.

The over-all forecasts on April 1 and May 1 proved to be high by 8.3 and 3.7 percent, respectively.

COLORADO—As indicated by the near record snow accumulation last winter, the flow of Colorado streams originating in the mountains was much above normal in 1952. This flow was generally not as high as expected because of extremely dry watersheds under the snow in some areas of the State. The total flow of Colorado River tributaries in Colorado was the highest in about 30 years. In spite of these high total flows, the snowmelt was extremely orderly, and no extensive flood damage occurred.

IDAHO—In general, the forecasts from snow surveys were for run-off much above normal. The forecasts, of course, were based upon the assumption that rainfall during the run-off season would be approximately normal. Such did not prove the case, but to the contrary, 1952 ranked up among the drier summers of record. This reduced the run-off from that which would have occurred under normal climate.

MONTANA—Precipitation over the entire State of Montana has been considerably below normal since the end of May. The lack of precipitation during August and September created a serious situation in unirrigated sections of the State. Fortunately, the summer streamflow held up exceptionally well. This, plus ample reservoir storage at the start of the irrigation season, brought irigated areas through in good shape.

NEVADA—The 1952 forecast for irrigation season streamflow was for above normal flow for all streams in the State. For Nevada as a whole, the 1951-52 snow season was probably the heaviest ever encountered here by the white man. Every snow course in the State at one time contained more snow than ever before measured. Some snow courses have 42 years of record. At Donner Summit, the total seasonal snowfall was greater than ever before recorded in the 73 years record. Sierra reservoirs were drawn down prior to the snowmelt season to create a cushion for the expected high summer flows.

Preliminary run-off records verify the "above normal" forecasts and, as forecast, indicate a greater run-off than normal.

NEW MEXICO—The water supply along the Rio Grande in New Mexico was generally inadequate again this season. The only exception was along the small tributaries in northern New Mexico. The flow of the Rio Grande through New Mexico was above normal but not as high as expected. Inflow to Elephant Butte was about average. Since the total storage last spring was low, early season water supply was very inadequate.

A rather large error of forecast was probably due to lack of information as to unusually dry watershed under the snow.

OREGON—Oregon's irrigated lands have enjoyed a banner water year.

Smaller streams have fallen off excessively in the last 2½ months due to prolonged drought. Substantial fall rains could make up the deficiency of watershed soil moisture. Otherwise, next summer's run-off from the coming winter's snow crop could be somewhat reduced.

SOUTH DAKOTA—The 1952 water supply on irrigated areas near the Black Hills in South Dakota was below normal. Soil moisture conditions are reported as poor and mountain watersheds as extremely dry.

UTAH—The April 1 run-off forecasts which indicated that record or near-record peak flows would be experienced on nearly all streams with considerable damage in vulnerable areas proved exceptionally accurate when the snowmelt run-off came.

Major flood damage occurred on the Weber-Odgen, Provo, Utah Lake and Jordan River drainages. Salt Lake experienced the most damaging snowmelt flood in its history when about 400 people were forced to evacuate their homes. Flood damage to farm and irrigation facilities alone was estimated for the State at $2,000,000. Damage to municipalities, highways, bridges, railroads, forest lands and roads would amount to several millions more.

Most damage resulted from melting of the exceptionally deep low and intermediate elevation snowpack during an extended warm period the last of April and first week of May. Run-off from the higher elevation snowpack was less damaging due to below normal temperatures during the rest of May and first week of June. Below normal precipitation during April and May was also a factor in reducing peak flow.

In general, yield from the low elevation snowpack was greater than anticipated, but the below normal precipitation during April and May somewhat compensated for it, with the result that most forecasts were very good. The largest error, 18 percent, was on Big Cottonwood Creek near Salt Lake City. A new forecast curve which has been subsequently developed, giving more weight to low elevation snows, would have forecast the run-off within 3 percent. Error of forecast on the Bear River at Harer is also due to the excessive yield from low elevation snows.

Run-off from springs is considerably higher than normal for this time of year and will have a carry-over effect on next season. However, unless October produces above normal rains, this carry-over effect will probably be minimized by the dry watersheds resulting from below normal precipitation during the summer and fall months.

WASHINGTON—Runoff data are curently available for only three of the streams forecast in April. In all cases, the measured run-off was materially less than forecast. The discrepancy is chargeable to the extended summer drought which prevailed. Less run-off from snowmelt was obtained than would have occurred with normal late spring and summer rainfall.

WYOMING—The irrigation water supply for the southern half of Wyoming was adequate for the 1952 season. The summer discharge of the Green, North Platte and Laramie Rivers was well above normal. On the North Platte, the reservoir system almost filled. There would have been uncontrolled spilling if water had not been released in advance of peak flow to avoid this condition.

The good to excellent water supplies forecast in western Wyoming materialized. ###

Soil Scientist Caswell Goes to Libya

Bureau of Reclamation soil scientist Alfred E. Caswell, left the United States in September on a Point Four project to help the people of Libya in their efforts to increase food production.

Mr. Caswell has been working during the past three years in the Bureau's offices at Casper and Cody, Wyo., on land mapping and land classification surveys.

Canadian Water Users Read ERA

According to a report from Ed Neal, supervisor of irrigation operation and maintenance on the Columbia Basin project, Ephrata, Wash., representatives of the Alberta Irrigation Projects Association at a meeting in Lethbridge, Province of Alberta, Canada, made numerous references to valuable information which they had obtained through reading the RECLAMATION ERA. Said Mr. Neal, "From references that they made, it was evident that the ERA is widely read by our Canadian friends."

Mr. Neal attended a meeting of directors, managers, engineers, and operating supervisors from irrigation districts in the Province of Alberta, representing about 250,000 acres. The Alberta Irrigation Projects Association paid for Mr. Neal's travel and subsistence and have asked that a speaker from the Bureau of Reclamation attend their meeting again next year. •

Columbia Basin's First Harvest

(Continued from page 266)

rant County public utility district which is ng to bring electricity to the farms in the first r of settlement, reported an increase of 11 per- in the number of customers in the past year. ventually, 14,000 irrigated farms will be ited within an area almost twice the size of State of Delaware and for each single non- gated farm today, there will be 25 farms which irrigated.

Much of the produce will be used to feed the wing population of the State of Washington. en L. Brough and E. L. Baum, from the De- tment of Agricultural Economics of Wash- ton State College estimated that if only half project land were devoted to dairying, the ject would hardly be able to keep up with the ry needs of the State, with the population con- ing to increase at the present rate.

If the population of the entire Nation continues increase at the rate of 2,500,000 persons a year, nomists estimate that by 1975, we will need 10 lion more cattle, 20 million more hogs, 3⅓ lion more sheep and lambs, 87 million more ing hens, and 6 million more milk cows.

Settlers on the Columbia Basin project, when y have completely developed its 1,029,000 es, will help raise $120 million worth of these m products each year (according to 1949 prices) is helping to fill that "fifth plate" at the tion's dinner table with food raised on irrigated ms. ###

Bureau Engineers Receive Awards

Eight Reclamation engineers who risked death drowning, exposure, or electrocution, deep in- e Grand Coulee Dam, were given awards for roism by Secretary of the Interior Oscar L. apman at a recent ceremony in Washington, C.

At Grand Coulee Dam, Wash., on March 14, an ecure cover to an inspection shaft tore loose er a giant outlet valve was inadvertently ened. The terrific force of the Columbia River s turned into the interior of the dam through e inspection shaft and began flowing into the o giant power plants located at the end of the m. The men waded waist-deep through 34- gree benumbing ice water, fighting surging current in an effort to reach electrical controls and cut off the water before substantial damage was done.

If the flow of water had not been stopped promptly, power production in the Pacific Northwest would have been seriously crippled and the effect of the loss of energy would have been felt throughout the country.

The eight to receive the Gold Medal Distinguished Service Award—the Department's highest honor—were, Norman G. Holmdahl, Donald D. McGregor, Milton L. Berg, John S. Bates, Harold E. Permenter, Irven E. Slaughter, Perry W. Crandall and James P. Green.

During the same ceremony, the Bureau's Chief, Engineer L. N. McClellan, who has designed most of the world's largest hydro power plants received the top Departmental Gold Medal Distinguished Service Award for "out-standing contributions to human progress both in this country and abroad." ●

Final Rio Grande Channel Contract Awarded

The second and final contract for channelization of the Rio Grande to provide an increased water supply for the drought stricken Middle Rio Grande Valley (see "Relief for Middle Rio Grande Valley," p. 289, Dec. 1951 issue of Reclamation Era), was awarded in September to the Clark Construction Co. of Kansas City, Mo.

The contract provides for channelization of a 10-mile stretch of the river extending north from San Marcial, New Mexico, and the construction of dikes, levees, drains, and culverts to control water flow in the stream. Work is scheduled for completion in January 1954.

Channelization of the 21-mile stretch of the River from San Marcial to the narrows of Elephant Butte Reservoir near Socorro, New Mexico, under the contract awarded last year is rapidly nearing completion. ●

Assistant Secretary Rose Resigns

Secretary of the Interior Oscar L. Chapman announced the resignation of Robert R. Rose as Assistant Secretary on September 2, 1952. Mr. Rose, who was in charge of the technical bureaus in the minerals resources area for about a year, returned to Wyoming as a candidate for election to the United States House of Representatives. ●

NOTES FOR CONTRACTORS

Contracts Awarded During September 1952

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Con[...] amo[...]
3128	Missouri River Basin, Mont.	Sept. 12	Construction of Tiber dam and dike and 115- and 12.47-kilovolt transmission lines.	Guy H. James Construction Co. and Wunderlich Contracting Co., Oklahoma City, Okla.	$12,8[...]
DC-3620	Middle Rio Grande, N. Mex.	Sept. 11	Channelization of the Rio Grande, fish and wildlife refuge to San Marcial.	List & Clark Construction Co., Kansas City, Mo.	71[...]
DS-3746	Central Valley, Calif.	Sept. 18	One main control board and one graphic and auxiliary control board for Folsom power plant.	Wolfe & Mann Mfg. Co., Baltimore, Md.	71[...]
DS-3747	Missouri River Basin, S. Dak.	Sept. 4	Two 115,000-volt and four 69,000-volt horn-gap switches and one 115,000-volt and six 69,000-volt disconnecting switches for Watertown substation.	Pacific Electric Mfg. Corp., San Francisco, Calif.	1[...]
DC-3754	San Diego, Calif.	Sept. 8	Construction of earthwork, pipeline, and structures for San Jacinto-San Vicente aqueduct, schedule 1.	R. V. Lloyd & Co., Coachella, Calif.	2,57[...]
DC-3754	do	do	Construction of earthwork, pipeline, and structures for San Jacinto-San Vicente aqueduct, schedule 2.	Engineering Constructors, Inc., Los Angles, Calif.	2,06[...]
DC-3754	do	do	Construction of earthwork, pipeline, and structures for San Jacinto-San Vicente aqueduct, schedule 3.	Johnson Western Constructors, San Pedro, Calif.	3,19[...]
DS-3757	Central Valley, Calif.	Sept. 18	Two 4,160-volt unit substations for Folsom power plant and switchyard.	I-T-E Circuit Breaker Co., Philadelphia, Pa.	93[...]
DS-3758	do	Sept. 19	Eighteen 75,000-pound radial-gate hoists for spillway at Nimbus Dam.	Willamette Iron & Steel Co., Portland, Oreg.	158[...]
DS-3759	Colorado-Big Thompson, Colo.	Sept. 25	Controlling station remote control and telemetering switchboard cubicle and equipment and controlled-station supervisory control and telemetering equipment for Flatiron power plant and Flatiron afterbay dam.	Automatic Control Co., St. Paul, Minn.	1[...]
DC-3763	Missouri River Basin, Wyo.	Sept. 8	Construction of additions to Thermopolis substation	Commonwealth Electric Co., Lincoln, Nebr.	18[...]
DS-3765	Central Valley, Calif.	Sept. 29	Three 230,000-volt circuit breakers for Folsom switchyard.	Brown Boveri Corp., New York, N. Y.	163[...]
DC-3769	Missouri River Basin, Mont.	Sept. 23	Excavation for Missouri diversion dam foundation	O'Neil Construction Co., Havre, Mont.	42[...]
DC-3775	Missouri River Basin, Kans.	Sept. 30	Two 4- by 5-foot high-pressure gates with two 110,000-pound hydraulic hoists, three conduit lining transitions, one hydraulic and one semiautomatic gate hanger, one single mercury switch, two 1¼-inch and one 1¾-inch standard shoulder eyebolt for canal outlet works at Kirwin dam.	Hardie-Tynes Mfg. Co., Birmingham, Ala.	[...]
DC-3779	Riverton, Wyo.	Sept. 26	Construction of earthwork and structures, Cottonwood drain, Wyoming canal lateral system.	Sharrock and Pursel, Casper, Wyo	[...]
DS-3794	Missouri River Basin, S. Dak.	do	Two 85-foot and two 225-foot fabricated structural-steel towers for Missouri River crossing of Oahe-Midland 115-kilovolt transmission line.	Westco Steel Co., Oakland, Calif.	52[...]
100C-152	Minidoka, North Side Pumping.	Sept. 15	Laterals from wells 4B824, 10A824, 10B824, 14A824, and 15A824.	McWaters & Bartlett, Boise, Idaho.	4[...]
100C-154	Boise, Idaho	Sept. 18	Carpenter shop and garage addition at Anderson Ranch Dam.	Prokesh and Howry Boise, Idaho	13[...]
117C-161	Columbia Basin, Wash.	Sept. 19	Additional laterals and canal structures, West and East Low Canal areas, W-3, W-4, E-2, and E-3.	McWaters & Bartlett, Boise, Idaho.	1[...]
200C-216	Cachuma, Calif.	Sept. 26	Repairing erosion damage and constructing asphalt-lined ditch for erosion control, South Coast, conduit.	Charles T. Richardson, Santa Barbara, Calif.	1[...]
601C-25	Shoshone, Wyo.	Sept. 3	Closed drains	Harry F. Berggren & Sons, Inc., Scottsbluff, Nebr.	54[...]
604C-28	Milk River, Mont.	Sept. 15	Siphons, check and wasteways, stations 865/50, 1147/27, 1195/43, and 1493/72, Vandalia South Canal.	Madsen Brothers & Graves Fairfield, Mont.	80[...]
701C-269	Missouri River Basin, Kans.-Colo.-Nebr.	Sept. 26	Installation of radio communication equipment	Neale Construction Co., Topeka, Kans.	14[...]
703C-259	Kendrick, Wyo.	Sept. 3	Earthwork and asphaltic membrane lining, Lateral 256, Stations 783/40 to 857/17.7.	Liebty Construction Co., Riverton, Wyo.	27[...]
703C-271	Kendrick, Wyo.	Sept. 24	Laramie substation additions	George W. Shelp, Rawlins, Wyo.	23[...]
703C-278	North Platte, Wyo.	Sept. 19	Rehabilitation at Fort Laramie Canal desilting basin	Henry F. Berggren & Sons, Inc., Scottsbluff, Nebr.	1[...]

Construction and Materials for Which Bids Will Be Requested by January 1953

Project	Description of work or material
Boulder Canyon, Calif.	Construction of laterals 116.1 and 118, including 3 outdoor-type 15.6 to 54 cubic feet per second capacity pumping plants, 1 equalizing reservoir, and 8.8 miles of 12- to 48-inch diameter concrete pipelines for part 1 of unit 8, Coachella distribution system, adjacent to Coachella canal southwest on Indio, Calif.
Central Valley, Calif.	Construction of Camp Creek diversion dam, a concrete overflow weir about 44 feet long and 10 feet high built on a rock foundation. Water it diverts flows through a 70-foot long headworks into Camp Creek Tunnel to Sly Park Reservoir. Headworks will be a part of this contract and requires a 7- by 7-foot radial gate. Work located on Camp Creek 2 miles east of Sly Park, Calif.
Central Valley, Calif.—Con.	Construction of 16 miles of precast 12- to 48-inch dia[...] concrete pipelines, including monolithic moss screens[...] pumping plant structures, and installation of moss sc[...] and pumping units for unit 2 of Saucelito irriga[...] district on the Friant-Kern Canal distribution sy[...] east of Pixley, Calif.
Do	Construction of laterals for the north section of Ma[...] distribution system's unit 1 near Madera, Calif., [...] prises 32 miles of laterals varying in bottom width [...] 6 to 18 feet. Laterals will be unlined or earth-l[...] Work includes construction of turn-outs, farm bri[...] highway crossings, division boxes, checks, and c[...] drops.

U. S. GOVERNMENT PRINTING OFFICE: 1952

Construction and Materials for Which Bids Will Be Requested by January 1953—Continued

Project	Description of work or material
al Valley, .—Con.	Construction of the remaining portion of Contra Costa Canal distribution system is to comprise 15.8 miles of 12- to 60-inch diameter reinforced concrete pressure pipeline between Antioch and Martinez, Calif., for Contra Costa County water district. The contractor will furnish and lay pipe, construct moss screen and turn-out structures, and install stationary moss screens, gate valves, meters, slide gates, pipe vents, and air valves.
------------	5 230-kilovolt air switches for Folsom-Elverta terminal switching facilities; 12 230-kilovolt and 5 115-kilovolt air switches for Folsom switchyard; and 1 115-kilovolt air switch for Nimbus switchyard.
ado-Big npson, Colo.	Installation of carrier-current equipment at Sterling substation.
hia Basin, n.	Construction of guard and firehouse headquarters building at Coulee Dam, a 1-story, 124- by 90-foot masonry structure with partial basement. Interior finishes will include plastering, acoustical treatment, and floor coverings on concrete floors.
------------	Construction of 5 wasteways of 5- to 35-cubic feet per second capacity, about 23 miles long with RI drops, culverts, farm and county road crossings, and bridges for lateral area W-3.
------------	Drilling an exploratory well in the P-9 area on Potholes East canal near Eltopia, Wash.
------------	Seven vertical-shaft motor-driven pumping units for area P-8 on Potholes East canal, as follows: one 2-cubic feet per second capacity at 16-foot head, one 2.3-cubic feet per second capacity at 18.5-foot head, one 3.3-cubic feet per second capacity at 13-foot head, one 2-cubic feet per second capacity at 10.5-foot head, one 6-cubic feet per second capacity at 29-foot head, and two 6.3-cubic feet per second capacity at 14-foot head.
------------	Three 24-cubic feet per second capacity at 50-foot head, horizontal-centrifugal type motor-driven pumping units for Eltopia Branch pumping plant.
Dam, Ariz.-	Installation of 10,500-kilovolt-ampere shunt capacitor and erection of additional 69-kilovolt bay and installation of 69-kilovolt oil circuit breaker and other equipment for the 16,000-kilovolt-ampere Cochise substation near Cochise, Ariz.
riz------------	3 indoor, 5,000-volt, 600-ampere, and 2 indoor 5,000-volt 1,200-ampere metal-clad motor-control switchgear cubicles for Wellton-Mohawk pumping plants 1, 2, and 3.
uri River n, Nebr.	Construction of 2.4 miles of 685-cubic feet per second capacity Courtland canal includes 9 embankment sections which are to serve also as detention dams. Work includes 5 timber bridges, 2 drainage inlets, 2 lateral turnouts, 9 detention basin evacuation conduits, and 0.4 mile of unreinforced concrete canal lining. Work located 3 miles southeast of Superior, Nebr.
Missouri River Basin, Nebr.—Continued	Construction of 20-mile reach of Bartley Canal, varying from 13-cubic feet per second capacity, 12-foot base to 42-cubic feet per second capacity and 6-foot base. Main structures are siphons, overchutes, culverts, turnouts, and timber bridges. Located near Bartley, Nebr.
Do------------	Construction of a 13-mile unlined reach of Franklin earth canal of 210- to 140-cubic feet per second capacity and 12- to 14-foot bottom width, for second section of Franklin canal near Franklin and Riverton, Nebr. Main structures include 15 precast concrete pipe siphons, 78 to 60 inches in diameter; 23 precast concrete pipe cross culverts, 9 timber highway bridges; 2 wasteways, and 5 baffled apron drops.
Missouri River Basin, S. Dak.	Construction of 20,000-kilovolt-ampere Rapid City substation near Rapid City, S. Dak. Work involves furnishing and erecting steel structures and a prefabricated steel control building measuring 24 by 50 feet, and installing government-furnished electrical equipment. Electrical equipment includes one 20,000-kilovolt-ampere transformer; 115-, 25.2-, and 4.16-kilovolt bus structures, circuit breakers, and switching equipment; one 10,000-kilovolt-ampere synchronous condenser, and a 200-kilovolt-ampere distribution transformer.
Do------------	Construction of 15,000-kilovolt-ampere Weaver substation for the Air Force base near Rapid City, S. Dak. Work involves erecting steel structures and installing government-furnished equipment including two 115-kilovolt-switches, one 15,000-kilovolt-ampere power transformer and one 2,000-kilovolt-ampere reactor.
Do------------	Construction of the following 115-kilovolt transmission lines in the vicinity of Fort Randall dam: Two parallel 12-mile transmission lines from Fort Randall tap to Fort Randall switchyard, Fort Randall-O'Neil 1.7 mile-extension into Fort Randall switchyard, and Fort Randall-Winner 1.7-mile extension into Fort Randall switchyard.
Rio Grande, N. Mex.-Tex.	Construction of 1,600 feet long by 42 feet high earth-fill North Branch dam on the Picacho Arroyo, 5 miles northwest of Las Cruces, N. Mex. Requires 160,000 cubic yard embankment.
Vermejo, N. Mex--	Rehabilitation of Vermejo dams involves construction of 3 small earth-fill dams for irrigation storage, including 4 concrete outlet works structures on the Vermejo River near Maxwell, N. Mex. The headworks structures include wasteway and canal outlet works for reservoir No. 2; inlet transition, concrete box drop and stilling basin for reservoir No. 7 and 8 Stubblefield: and concrete box, inlet transition, and stilling basin for reservoir No. 13.

United States Department of Interior, Oscar L. Chapman, Secretary
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THE RECLAMATION AREA

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52

Official Publication of the Bureau of Reclamation

December 1952

Volume 38, No. 12

The Reclamation ERA

35 Years Ago In The Era

Your War Contribution—Bread or Meat?

Meat rather than bread should be the principal food contribution of the reclamation projects . . .

Feeds not available or needed for human consumption should be used as largely as possible in feeding live stock. By feeding straw or corn stover, especially for wintering mature stockers and breeding animals, farmers will make the best possible use of these roughages. In this way a large proportion of the straw and stover ordinarily burned or wasted can be manufactured into meat and milk. Grain sorghums, whenever they are available, should be fed to release corn for human uses. Grain, where fed, should be used as economically as possible.

Every animal should be a factory for turning into food material inedible for human beings.

(From an article prepared by the United States Department of Agriculture on page 573 of the December 1917 issue of the RECLAMATION RECORD, predecessor to the RECLAMATION ERA.)

OUR FRONT COVER. WINTER WONDERLAND for summer dividends. Conservation and distribution of the water stored in the snow banks and used for irrigation pays enormous material dividends to our national economy. This scene on the Boise project in Idaho photographed by Phil Merritt.

OUR BACK COVER is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners Kittredge and Coolidge.

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R. F. Sadler, Editor

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In this issue . . .

RECLAMATION
PLACE NAMES
IN THIS ISSUE

SIX LOADS TO SHOULDER

apted from remarks by U. S. Commissioner of Reclamation CHAEL W. STRAUS at the Annual National Reclamation sociation Convention, Long Beach, Calif., November 14, 1952.

RECLAMATION SHOULD BE AN OWNER-OPERATED TERPRISE in which the stockholders play full d active part.

We in Reclamation have been recommending eater local and State participation in provid- g Reclamation development for years and have ne a long way in providing mechanics to prac- e it. Local and State participation is built into clamation by law and policy.

Under present laws and policies, no project can built without a community's clamoring for it, proving the plan, and forming voluntarily a al water users' organization, properly set up der valid and appropriate State law, which kes a contract to repay its share of the allocated sts; and this contract must be approved by a te of local members and confirmed by a court signated by State law.

The local interests must by law be kept informed all developments in the investigation. After e proposal is ready for submission to the Con- ess, it must by law be submitted to the States d other Federal agencies involved for review. e Bureau's policy is to submit the proposal to e water users' organizations and other local encies, as well as to the States. At the same time we issue a public proclamation and accounting, and thus, in effect, we submit the proposal to the scrutiny and approval of the world.

Next, the project must in most cases be authorized and in all cases financed by the elected representatives of the local people in Congress. And finally, when the project is finished, it is offered, with all the insistence of which we are capable, to the local water users for operation and maintenance.

These are the formal and required steps which safeguard and insure local participation. In practical work, the number of informal contacts and relationships is almost infinite. Settling farmers on new land; collecting construction charges; making rehabilitation and betterment arrangements; amending contracts as economic circumstances change; conforming not only with State laws, but with State plans and programs; cooperating in the many programs incidental to water-resources development; all these activities go to make up the great network of Federal-State-local-individual partnerships which is Reclamation.

Thus the local interest in Reclamation is amply protected under our present laws and policies; but there is another and stronger reason for seeking more local participation, control, and responsibility. It is simply that our job is big and broad

(Please turn to page 296)

TE GOVERNORS TO ASSIST in dedicotian Dovis Dom, on the Colorodo river near gmon, Ariz., on December 10, 1952. ernors of the 11 Western States, Con- ssionol delegotions ond representotives n Mexico have been invited to porticipate this dedicotian of one of Reclomotion's tiple-purpose dams with which the woter urces of the Calorodo River, which rses thraugh 7 States, ore being develaped beneficiol use. It provides 225,000 kila- tts of low-cast power plus other benefits Nevoda, Arizana, and Califarnia, ond re- ulotes the river for downstreom irrigotian under the treaty with Mexico. *Photo by Blew, Region 3 photographer.*

THEY INCORPORATED 8 farm units as the South Winchester Water Association. Driller Jack Harrison (back to camera) starts the well as officers of the S. W. W. A. look on. From left to right: President Virgil Townsend, Vice President William Bennett, and Secretary-Treasurer John Baird (attorney).

THEY DID THE WORK.—Settler Art Johnson, foreground, hol pipe, W. C. McDonnell, center, and Clarence Schwebke wor on ditch in background, helping to bring their own domestic w to the Westmont Acres Water Association's part-time units Soap Lake, Wash., on the Columbia Basin project.

Domestic Water for the Columbia Basi

by ORLAND H. TONNEMAKER

County Extension Agent, Grant County, Washington

"How and when can we get domestic water?" That is usually the first question asked by new settlers on the Columbia Basin project after they have picked out their farm units.

And here in the State of Washington, three agencies are working together to aid the new settlers in getting good wells as rapidly as possible. The United States Bureau of Reclamation with the concurrence of the Farmers Home Administration and the Washington State College Extension Service has published a Feasibility Report on which is located a source of domestic water for every farm unit in the Columbia Basin. These agencies also have a three-way mutual agreement to help the settlers plan individual wells or a group well to be shared by neighboring units.

The feasibility reports give the expected depth of all wells in the entire area, the estimated cost of the well for every farm unit, and also map out expected building sites for the homes on each farm unit, indicating the size of pipe needed to carry the water from the group wells to all the farm units.

All of this information including a definite p posed location for each well, can be read from t map for each irrigation block.

As soon as there are enough neighbors settled the area, a meeting is held to answer the questi of how and when they will get their "runni water." Explanation of the reports is properly function of the County Extension Service, usually it also requires the help of Mr. Wis Burgess, local supervisor of the Farmers Ho Administration and Gordon Anderson, Farm Home Administration engineer.

W. O. Watson and T. H. Griffin, Bureau of R lamation engineers, have calculated on these ports the cheapest and most feasible way to water. Some are figured on private systems, so in groups of two or three and the rest in lar groups.

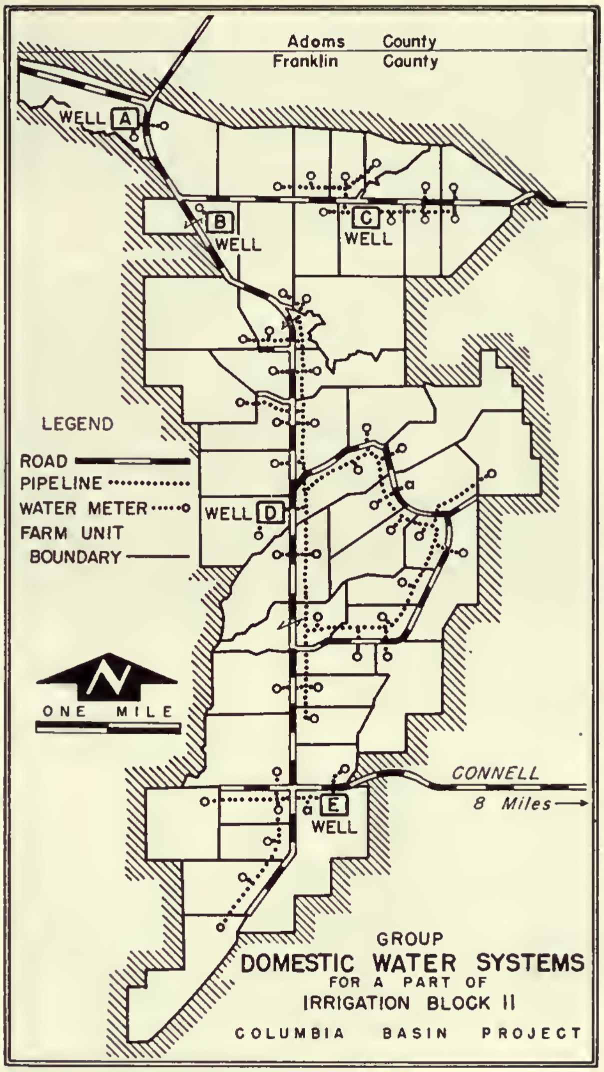
When new settlers learn in a meeting that th can get city water pressure and city water serv out on their isolated farm units by group together with their neighbors and at the same ti make a saving averaging from 10 to 80 percent ıe cost of the well they say, "Why wait?"

But they still have another surprise. If they ill group together they can buy an equal share in group well for much less than a private well ould cost; but if they will incorporate this group nder the laws of the State of Washington, they ill then be allowed to borrow 90 percent of their hare of this well at 3 percent interest for a 20-year epayment period. This 90 percent loan is secured y a mortgage on the well system, thus leaving heir capital and credit free to be invested in other ecessary improvements.

This loan program of the Farmers Home Ad- inistration is one of the most popular ever ntrusted to that agency by the Government. At his point, the group usually starts to incorporate. t takes five signers to incorporate, so usually wners of five farm units become incorporators or each group. Then the F. H. A. engineer works p a new estimate for this group for a domestic ater association.

It often comes as a matter of surprise to them hat they are to operate this entirely by themselves. ften the question is asked, "When are you going hire the well drillers?" It is then they learn

(Please turn to page 297)



IEY GOT EXPERT ADVICE on the best and cheapest ways of get- ng "running water" to their farms. Below, front row, A. F. nzler, Ralph Enzler, Sam Palmerton, and Glenn E. Morland. cond row, Mrs. T. H. Lowe. They since have incorporated as e Wheeler Water Association. At the back of the room, from ft, Grant County Extension Agent Orland H. Tonnemaker (author article); Ray Toll, and A. Gordon Anderson, both of Farmers ome Administration. At right, a map for irrigation block 11, owing the possibilities for locating wells and pipelines. *All otos for this article by Ellis Shorthill, Region 1 photographer.*

229749—52——2

HEADING OFF THE SLUSH FROM THE HEADGATE.—(1) Wind River Diversion Dam and headgote of the Wyoming Conol, with dotted line indicoting the locotion of the by-poss channel when the water bock of the dom freezes solid; (2) ond (3), opening o chonnel in the ice behind the dom to corry the slush ice through the log-woy, ond thereby divert it from the heodgote of the conol which feeds woter to the Pilot Butte Power Plont. Tempero-ture—25 degrees below zero.

RIVERTON'S "SLUSH PLOW"

SLUSH OR FRAZZLE ICE has often threatened t "black out" the Riverton project in Wyoming.

But since the winter of 1948–49, a "slush plow" devised by Karl Powers, irrigation manager fo the Midvale irrigation district, an organized wate users group of the project, has not only ended thi threat, but saved almost $19,000 in one season.

The Pilot Butte Power Plant, which has been i operation since 1925, depends upon a 9-mile-lengt of the Wyoming Canal to deliver the water fo generating electricity. During the severe, sub zero winter months, a granular form of ice know locally as slush ice can cut off the flow of water int the canal.

When the temperature is below 25° Fahrenhei this slush ice appears in the swifter flowing reache of the Wind River which do not freeze over solid As slush ice apparently forms around minute par ticles of silt or sand, it is slightly heavier tha surface ice and is carried along downstream b the swift currents until it reaches slower sectio of the river where the surface is completely frozen Here it follows the current underneath the ice.

When slush ice reaches the Wind River Diver sion Dam, which channels water into the Wyomin Canal, its natural tendency is to follow the cur rent to the canal headworks, pile up against t ıal gates, clog the works, and cut off the flow of ter to the open Wyoming Canal. Thus, a source electricity in the Wind River area can be com-tely shut off.

During the first 2 years of operation slush ice nost caused the power plant to shut down. Then gan the heroic efforts of the Riverton project's erating staff to live up to its motto, "The water ıst be delivered." Page 1 of the January 1948 ue of the RECLAMATION ERA carries a graphic cription of the hazardous job they undertook ır after year. They cut a diagonal channel in solid ice upstream from the diversion dam, ding to the spillway. Crews of 12 to 15 men rked 24 hours a day for periods of a month or re in temperatures ranging from zero to 50° ow zero, trying to detour the slush ice from the ıal gates to the spillway.

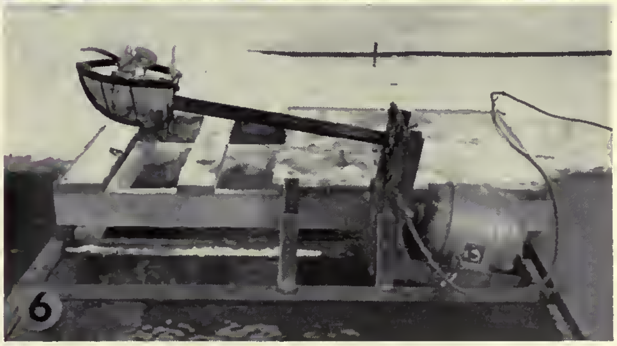
The Wind River is aptly named. Sometimes 40-le-an-hour winds blew men into the slush-laden nnel. Occasionally they would slip on the ice d take an unexpected dunking in the freezing ter. But in spite of all the hazards of the job, one drowned or lost his life, primarily because crews were always on the alert for such con-gencies.

Sometimes, even with a large crew of men on the and with their best efforts, the channel could t be kept open. As the demand for electricity reased, the situation became even more serious, increasing amounts of water were needed for power plant during the winter months.

Adding to the severity of the problem is the fact t the diversion dam raises the normal water sur-e of the river about 18 feet, thus creating a con-lerable forebay of still water. Whenever slush blocked the canal headworks and the diversion rks too, the river rose as much as 15 feet, and oded nearby ranches.

In order to live up to their motto, "The water ıst be delivered," the Riverton project staff ded another one, "The slush ice must be kept oving."

During the winter of 1948–49, Karl Powers gan to experiment with an idea of his. He took ne large outboard motors, the kind that are used r boats, slung them on an iron angle frame which nned the open cut in the ice, wired the out-ards to an electric motor, and let the propellers urn away—stirring up the slush ice, keeping it oving down the river, insuring water deliveries Pilot Butte Power Plant, and saving a lot of ck-breaking, dangerous hand labor.



THE "SLUSH PLOW" IN ACTION.—(4) The new electrically driven propellers detouring the slush ice. Note agitation of the water. (5) The new ice-moving machine, with the propeller in the water. (6) View showing propeller shaft of the "slush plow."

Powers and his crews have gradually improved on the idea. At present, the electrically-driven propellers have replaced almost all of the hand labor formerly required. During the past winter, except for 1 week when additional help was needed, the regular gate tender and one extra employee kept the channel open.

Records show that removing slush ice, prior to the use of the machines, cost as high as $22,000 in one season. During the 1951–52 winter, the work cost only $3,134, representing a possible saving of almost $19,000 in one season. At this rate, in 22 years Riverton project operators will save as much as the entire power installation cost to begin with.

The "slush plow" has been adopted as a standard operation on the project, and could undoubtedly be used to advantage on other projects. # # #

229749—52——3

DAIRY DIVIDENDS

MORE THAN $3,000 A YEAR.—That is the amount saved by pasturing registered dairy cows o the only sprinkler-irrigated farm in the Tucumcari project, in New Mexico, shown above.

How A Tucumcari Farmer Makes A Profit on his Sprinkler Irrigated Pasture

by GARFORD WILKINSON
Regional Information Officer
Amarillo, Tex., Region 5

W. H. Ingram, The Only Sprinkler Irrigator on the Bureau-built 42,000-acre project at Tucumcari, N. Mex., does not look upon himself as an individualist. For the most part, he contends that sprinkler irrigation is particularly advantageous to his land and dairy operations.

It is a fact, however, that the Ingram sprinkler system forges an assembly-line reaction that is unique on the Tucumcari project. The sprinkler irrigation adds abundantly to the grass the cows eat to produce the milk that is processed in the Ingram dairy and marketed by Mr. Ingram in the wholesale and retail trade in the form of pasteurized milk, cream, butter, and ice cream.

The Tucumcari project lands range in elevation from 3,900 to 4,100 feet above sea level. There is much sunshine, characteristic of the Southwest. The air is dry, with high evaporation. Annual precipitation averages 16.42 inches. The frost-free period averages 195 days out of each yea

For the last 5 years Mr. Ingram has maintaine 22 acres of permanent seeded pasture, divided int 6 plots of 3¾ acres each. He recently seeded 1 additional acres. He uses the following 11 poun mixture per acre: Orchard Grass, 5.3; Perenni Rye, 1.1; Ladino Clover, 1.1; Alsike Clover, 1. Alfalfa, 2.2.

The Ingram land, just east of the city of Tu cumcari, is rolling and would be very costly level for surface irrigation. Moreover, his dai hands are fully occupied only a few hours ea morning and evening. At other times each da they are available to operate the sprinkler syste

Up to this year, Mr. Ingram calculated his an nual net income from his pasture program at $ per acre. These earnings are not spectacular, b they are impressive, considering the type of so on which the pastures were first planted and th characteristics of the area.

Mr. Ingram says he has pastured up to 65 hea of dairy catle on 22 acres for 3-week periods wit out adversely affecting the grass. He mows th sture, on which the cattle are rotated at regular tervals, about every 30 days and drags a harrow hind the mower to scatter the droppings. The stures require an irrigation every 7 to 10 days.

To cite the value of his pasture program, Mr. gram has a cost-income chart which, unfortutely, was compiled prior to the strong advance feed prices. His figures reflect a period of 190 ys, with 36 cows at pasture, although his pasre-use season ranges from 200 to 210 days over a year period. He saved $2,470 on hay alone in e recorded 190-day period, based on his estimate at his herd would have consumed 13 bales of y daily at a cost of $13 had pasture not been ailable. Savings on grain amounted to $1.26 ch day, or $239.40 for the full 190-day period. e estimated his pasture increased the milk output 10 gallons a day or $5.60 per day, $1,064 for the ll period. Total savings were $3,773.40.

Contrasted with the savings are the following sts of maintaining the irrigated pastures:

st of fertilizer at 600 pounds per acre—totaling 13,200 pounds	$561
tal cost of applying fertilizer, 8 days' labor	80
owing and harrowing, 8 days' labor	80
ectricity to pump water every 9 days	380
st of water at rate of 5 acre-feet for each irrigation for a total of 105 acre-feet at an average cost of $3 per acre-foot	315
epreciation on equipment, tax, and repairs	275
st of applying water 3 hours daily	420
Total costs	2,111

Total estimated income as compared with the additional costs of maintaining a pasture indicates an operating profit of $1,662.40 or a per acre profit [1] of $75.50.

Although Mr. Ingram is a veteran in the dairy business, he got into it by accident. He had decided to give the pick and shovel end of Arizona's mining industry a whirl in return for going wages. But a chance acquaintance 25 years ago of the tall, raw-boned midwesterner, then in New Mexico en route to Arizona, steered him into a commercial dairy. About two decades later, while the Bureau was putting finishing touches to the Tucumcari irrigation project, Mr. Ingram set forth on his own for Tucumcari, where he established a creamery, an ice cream manufacturing plant, an outlet store for his dairy products, and began building an irrigated pasture program for his own dairy herd.

Mr. Ingram's multiple commercial enterprises, coupled with his pasture irrigation program, keeps him as busy as a bee in a bundle of blackberry blooms. He flies his own plane to dairy herd improvement meetings and conventions of creamery operators. Most of the time, however, he is irrigating, milking, churning making deliveries, or favoring friends with products of his pasture—ice cream, and milk shakes. # # #

[1] Estimated prior to the more recent sharp increase in cost of feed. Labor and all other costs unchanged.

W. H. INGRAM'S MODERN MILKING PARLOR, a two-minute stroll from the productive and profitable irrigated pastures. *Photos for this article by Fred S. Finch, Region 5 photographer.*

NORTH DAKOTA'S SOIL TRAIN

by RAY O. PETERSON,
Settlement Specialist, Bureau of Reclamation, Region 6

KNOW YOUR SOIL—HOW IT WAS FORMED, HOW TO CONSERVE, PROTECT AND USE IT WISELY TO PROVIDE THE NEEDS OF HUMAN LIFE THROUGH THE PLANTS THAT GROW ON IT.

This theme was effectively presented by the North Dakota State Agricultural College last winter through a "soils special" train that made stops at 54 towns in the State.

The importance of our greatest national resource—the soil—was uniquely shown by means of a display of soil profiles, charts, pictures, demonstrations, and research data illustrating how our present soils required thousands of years to develop, the damage that can be done to them by improper use, and how they can be protected and even improved by following good soil management practices.

A total of 54,400 people made the guided tour through the train, a large number, considering that the farm population in the State is only 200,000 and heavy winter snow made travel in rural areas difficult.

The "soils train" which was developed by the North Dakota Agricultural College and routed in cooperation with three railroad companies, the Great Northern, the Northern Pacific, and the Soo Line, consisted of three passenger cars from which the seats had been removed. The cars were equipped with excellently prepared displays that traced the soil from its origin through its response to intelligent use. A fourth car was used to seat visitors until groups of 10 to 20 could be assembled to make the trip through the car. Each railroad company furnished one car to carry part of the exhibit and the fourth car was supplied by the company on whose line the train was being shown. The agricultural agents from the railroad companies met the visitors and explained the general features of the "soils special," organizing them into groups to be conducted through the train.

Local arrangements for showing the train and conducting the meetings were made by the county agent working with committees. The power companies and cooperatives provided the electrical hookups to light the cars. Soil Conservation Service personnel assisted in supplying material and conducting groups on the tour of the exhibit.

The first part of the exhibit was a display on the basic soil features which described the processes through which soil was changed from rock to a "thick granular, fertile, and high humus soil." By using actual soil profiles the different kinds of soils found in North Dakota were clearly

IN PLACE OF THE LOWER BERTHS—the story of the birth of the soil, in colorful, easy-to-read exhibits.

KEYS TO SUCCESSFUL FARMING—graphic illustrations of how to use even the poorer soils to best advantage.

FOR LAND'S SAKES—save the soil, was the theme of the North Dakota Agricultural College's campaign. *Drawing by Lloyd Chellmon, Graphics Section.*

scribed. This brought out the different uses to ich each kind of soil is suited, and showed that ne soils can be used for grain, row crops, hay l grass while others are suitable for native sture only.

The importance of proper soil management was phasized by a display showing the need for comrcial fertilizer, green manure crops and barnrd manure in securing maximum crop producn. Research work conducted by the North kota Agricultural College shows that dry-land eat yields have been increased 4.5 bushels per e, barley 6.3 bushels and oats 7.2 bushels per e by adding phosphate fertilizer. Wheat folving corn, a legume and fertilizer yielded 50 rcent more than continuous wheat.

Along with this part of the exhibit a display nted out the value of summer fallow and other age practices in crop production. Experiment tion results demonstrated that dry-land wheat lds could be doubled by summer fallowing and tilizing the land. The visitors saw why the face soil should be protected from wind and ter erosion, and how the loss of topsoil reduces p yields, and in some cases, makes the soil fit for crop production.

The importance of livestock in good soil management was demonstrated in another section which illustrated how the soil needs forage crops in rotation and livestock are needed to utilize these feed crops on the farm. The value of proper stocking of pastures was illustrated by a miniature pasture that was overgrazed and one that was pastured wisely.

Another display provided basic information on irrigation in North Dakota. It pointed out the requirements of water and soil for successful irrigation. Profiles of soils that were suitable for irrigation and those that were not suited were displayed. The benefits of irrigation were illustrated by pictures and figures on yields of irrigated crops and pastures. A striking illustration of the value of irrigation water was a picture of the dairy cows on the Mandan Development Farm pasture on which 18 Holstein cows grazed on 7.6 acres during 1951 and produced 8,000 pounds of milk and 300 pounds of butterfat per acre.

Following each showing of the "soils special" a farmers' meeting was held and the more important recommendations on soil management for the soil conditions found in the specific area where the train was being shown were explained in detail.

Soils specialists with the college discussed the

(Please turn to page 291)

W TO GET THE MOST FROM THE SOIL was depicted in minia- scenes of "do's" and "don't's" for farms.

IRRIGATION AND LIVESTOCK FARMING GO TOGETHER according to this display of suitable soils for irrigation.

THE FLOOD OF JUNE 15, 1935.—Looking south along Congress Avenue, Austin, Texas, with the Colorado River flooding the streets. The building in the foreground with advertising signs at each end can be seen in the photo on the following page.

by HARRY P. BURLEIGH, Area Planning Engineer, Austin area planning office, Austin, Tex., Region 5

AFTER YEARS OF DROUGHT—A DELUGE.

Within 3 days, from September 9 through 11, 1952, the central part of Texas was drenched with long awaited hydrologic manna. A storm originated in the Gulf of Mexico, southeast of Corpus Christi, traveled inland in a northwest direction, and dumped its load of H_2O over the "Hill country" formed by the Edwards Plateau. Heavy torrential rains beat upon the hard-packed surface of the area, ran down the banks of the streams, and rushed down the shell-shaped plateau on its way back to the Gulf. About 8 people lost their lives and many bridges were washed out on streams leading to the Colorado and Guadalupe Rivers which drain the area. Rainfall alone rose to 22 inches near Johnson City; the rivers swirled even higher as the flood crest gathered momentum and water from the contributing streams.

But multiple-purpose, basin-wide planning paid off.

A lesser flood (481,000 cubic feet per second crest) in 1935 caused flood damages amounting to $12,735,000, along the Colorado River and its tributaries. This year, damages were reduced to an estimated $1,181,300, due mainly to the existence of multiple-purpose structures along the Colorado River. Before the September storm, the reservoir behind Marshall Ford Dam (designed and built by the Bureau of Reclamation) and Buchanan Reservoir (created by the Lower Colorado River Authority) were empty. During the storm, the two man-made lakes held more than 1,000,000 acre-feet of the floodwaters, with space left over. The United States Geological Survey has estimated that peak discharge of the Colorado River during this year's storm would have reached 600,000 cubic feet per second at Austin without Marshall Ford Reservoir and would have caused heavy damages along the river at and below Austin.

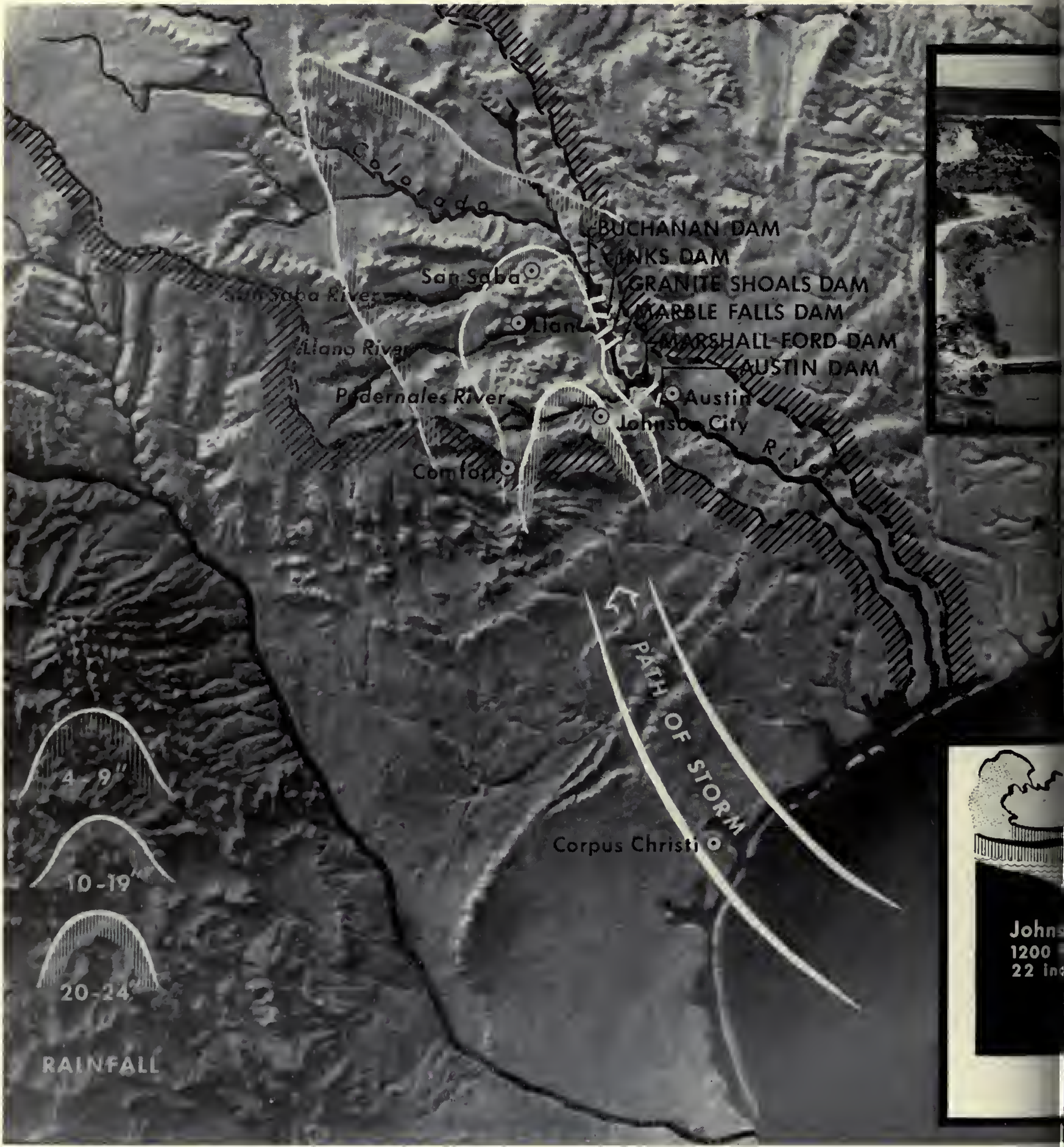
PROTECTION DURING FLOOD OF 1952.—Looking north on Congress Avenue. The "Y" intersection (foreground) barely shows above water in foreground of other picture. The white stuff isn't snow—it is sand. *Both photos by Neal Dougloss, Austin, Tex.*

The peculiar geological formation of the plateau, with its sloping shelf to the Balcones Escarpment and its limestone land surface, fairly high-stream gradients, and basin slopes, makes it particularly susceptible to flood damage. Heavy rain usually produces excessive and immediate runoff.

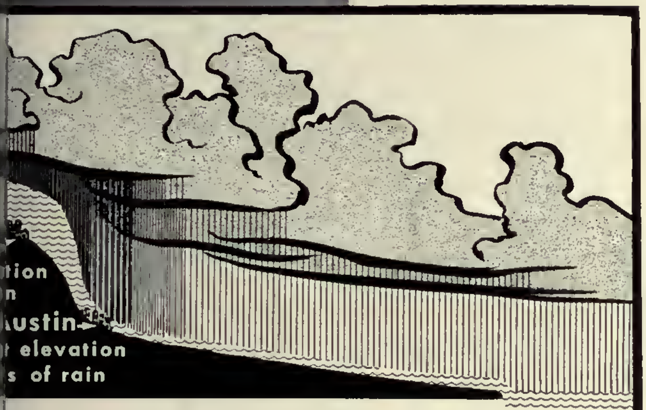
In 1869 a storm comparable to that of this year resulted in a discharge of 500,000 cubic feet per second in the Colorado River at Austin. Lesser floods, varying in peak discharge from 135,000 to 164,000 cubic feet per second have been recorded at Austin in 1900, 1913, and 1915.

Texans, discouraged by the magnitude of recurring flood damages, and impressed by the economic potential of a controlled river regulated for beneficial use of water, had created the Lower Colorado River Authority in 1934. The authority, established as a governmental subdivision of the State, was given a broad directive to prevent future flood damage and concurrently extract from regulated flow of the river all possible beneficial use. How well the authority has succeeded in its mission to date is clearly demonstrated by the magnitude of flood damages prevented during the recent storm by lower Colorado River reservoirs, and by the dependable water supplies that have been made available from the reservoirs for municipal water supply, power production, and irrigation water supplies during the past 5 years of subnormal rainfall and stream flow.

Over the past 17 years the authority has created about 2,580,000 acre-feet of storage capacity in two basic storage reservoirs, Buchanan and Marshall Ford; allocating 780,000 acre-feet to flood control, 1,800,000 acre-feet to power and conservation storage. Four smaller reservoirs (Inks, Marble Falls, Granite Shoals, and Austin) have been created to develop additional power from the regulated waters released from Marshall Ford and Buchanan dams. These releases provide dependable water supplies for Austin, a city of 140,000 people, and for irrigation of 110,000 acres of rice along the lower reach of the river.



STORM IN SEPTEMBER swept in from Corpus Christi and dumped its load as indicated above. Torrential rains ran down the slopes towards the rivers and streams but were caught by the multiple purpose structures shown on the map. Inset at upper right is Marshall Ford Dam, designed and constructed by the Bureau of Reclamation for the Lower Colorado River Authority. The cross-section diagram at lower right gives some idea of the slope of the land and the constant menace to the capital of Texas, the city of Austin, in the path of heavy flood waters due to rapid runoff from recurring storms. *Drawing based on information supplied by the author, Harry P. Burleigh. Design by the Graphics Section, Washington, D. C. Map based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners, Kittredge and Coolidge.*



ELEVATION AND RAINFALL

With 1,045,000 acre-feet of new water in storage and available for use by municipalities, irrigators and power users; with heavy flood damages along the Colorado River being prevented; and with 1,257,000 acre-feet of storage remaining to absorb additional runoff, Texas has concluded that the multiple-purpose-project approach as applied on the Colorado River has demonstrated its value. Most Texans agree that the Lower Colorado River Authority program accomplished to date looks particularly good in view of firm water supplies that have been available over the past years of drought and low river runoff.

The need for comparable developments on other Texas rivers is becoming increasingly apparent in view of the rapidly mounting water requirements of many Texas cities, particularly in areas where the new petro-chemical industries are seeking industrial water supplies in quantities heretofore considered fantastic. Also 2,400,000 acres or about two-thirds of the present area irrigated in Texas (3,700,000 acres) is dependent upon generally declining ground-water supplies which eventually will have to be supplanted or supplemented by annually replenished surface water supplies if the 40 percent of gross crop income in the State, presently derived from irrigated agriculture, is to be maintained permanently.

The Bureau of Reclamation designed and built Marshall Ford Dam for the Lower Colorado River Authority using Federal funds provided by the Secretary of the Interior acting as Public Works Administrator. All told, 90 percent of the cost of Marshall Ford, Inks, Austin, and Buchanan dams, approximately $39 million, came from Federal funds of which over $10 million has been repaid to the Federal Treasury. And Federal contracts with the River Authority call for additional payments in the future. Bond issues were used to finance Marble Falls and Granite Shoals Dams.

Power from Lower Colorado River Authority turbines, and water supplies provided from the storage reservoirs, have been solid factors in the Texas share of past defense efforts and now represent indispensable tools in the present rapid industrialization of southern Texas. The job of the River Authority is by no means complete, and it is fashioning additional plans for further utilization of the river.

No doubt the future work of the Authority will continue to be joint ventures of Federal and local agencies. The history of the Lower Colorado River Authority shows clearly that Federal and State Governments can join forces to develop water resources and to eliminate flood hazards through multiple purpose projects. The benefits of a well conceived, locally managed river development accrue not only to the State or region but to the Nation. ###

ALTUS FARMERS SPEAK UP

Part 3—Southall and Kelley

by U. H. WARNER, Editor, the Geary Star
Geary, Oklahoma

16 CATTLE ON 6 ACRES OF IRRIGATED PASTURE, according to Bob Southall (top photo), made his Altus farm a mecca for visitors, Murrell Kelley (immediately above) raised 7 tons of alfalfa per acre. ***Photos by Fred S. Finch, Region 5 photographer.***

An irrigated pasture one mile north of Humphrey attracted so much attention from county agents that hundreds of visitors went to see it last spring and summer.

The owner, Bob Southall, told us that he got ashamed of his old loose-wire corral which they walked past enroute to the pasture. Now, he has a nice, straight corral with the boards all white-washed ready for the 1953 influx of 4–H and FFA boys and agricultural experts.

Southall planted and irrigated a 12-acre pasture in 1951. He used alfalfa, brome, fescue, rye grass, dallis grass, and orchard grass in the seeding. His 16 beef animals got so far behind with their eating in a few months on the luxuriant growth on this 12-acre plot that he ran an electric fence down the middle and left them only 6 acres for grazing.

The 6 acres proved to be ample for the grazing needs of the 16 cattle. He cut some good hay crops off the other half of the field. County agents say it takes around four acres of nonirrigated pasture to feed one cow in this section of Oklahoma.

Southall irrigated 18 acres of alfalfa last summer and made five cuttings of hay. He sold it at $40 per ton for a return of $102 per acre from the 1951 crop.

The Southalls have all the modern conveniences in their spacious rural home and also own a home in Altus. Mr. Southall is a nephew of L. E. Grimes, of Geary.

Their farm is so perfect for irrigation that they can have a little variety in their watering. Southall ran his water from west to east for a while, then decided on a change. He took it across the fields from north to south the last year with equal ease.

Record Hay Production

Altus experiment station records show that Murrel Kelley produced an average of 7 tons of alfalfa per acre on 30 irrigated acres to top the record in hay production.

Kelley finished his noon meal and came into the ing room of his modern new home to greet us hen we called at his place on March 21. Mr. and rs. Kelley have a 77-acre tract which borders the wn of Hester on the north side.

He told us that he raised his alfalfa to prepare e ground for row crops. Since going to row ops, he has had his best success with cotton. He rned out 37 bales on 27 acres in 1950 and harsted 70 bales from 60 acres last year. One 6-re plot which he had to replant on June 28 came rough with eight bales of cotton. Farmers in e area who did not have irrigation were lucky to ke from one-fourth to one-third bale per acre to e Jackson county gins in 1951.

"I never had seen irrigation until we started in re at Hester," said Kelley, "for I was raised at pton in southern Oklahoma.

"I decided I wanted to have some land where I uld get water for my crops whether it rained or t, so I came up here and bought this land when heard there was going to be an irrigation strict."

This concludes a series of interviews with successful igation farmers of the W. C. Austin project in southstern Oklahoma, by Mr. Warner, publisher and editor the Geary Star, and also president of the Geary Char of Commerce. These interviews were the result of . Warner's interest in the proposed Canton irrigation oject in the North Canadian River Basin in west-central lahoma, now under study by the Bureau of Reclaman. Under the project plan, 16,000 acres of fertile allul lands along the right side of the North Canadian ver Valley, could be irrigated by water made available om Canton Reservoir, completed in 1948 by the Corps Engineers, Department of the Army. Irrigation outlets rks were incorporated in the dam so that the distribun facilities could be constructed when the irrigation ases of the project were authorized. ###

North Dakota's Soil Train

(Continued from page 285)

story and development of the soils of the comunity in which the meeting was held and stressed e management practices dictated by the nature the soils and their environment. Information esented emphasized that North Dakota's dry imate makes too little water one of the main ings that limits crop and pasture yields in most ears.

Representatives of the Livestock Department of e College Extension Service discussed the pasre management practices that would give the eatest production and maintain good cover. hey also pointed out the place of livestock in a od soil management program.

Agronomists presented specific recommendations on the use of fertilizers and cropping practices in promoting high yields and protecting soil against erosion.

Tillage and irrigation practices were also discussed by Extension Service personnel. Interest in irrigation in the State is increasing and many questions were asked on soil and water management and methods of applying water to the soil. Farmers were advised to be sure of an adequate supply of water before irrigation is started, to have the water analyzed to determine whether it is suitable for irrigation, and to have the soils and drainage examined to see whether irrigation could be successful.

H. L. Walster, Dean of the North Dakota College of Agriculture and director of the experiment station, summarized the story presented by the "soils special," in a bulletin which carried the following statements:

Take care of the soil—our greatest resource.

Hold it against . . . blowing winds and running waters.

Clean it by . . . crop rotation—fallowing—weed eradication

Reinforce it with . . . grass and humus.

Strengthen it with . . . plant food from manure and fertilizers, and soil-improving crops.

Guard it always against . . . erosion—depletion—and contamination. # # #

Irrigation District Saves $19,000 on Power Contract

The West Side Irrigation District of Tracy, Calif., first preference customer to contract for power after the Bureau of Reclamation and the Pacific Gas and Electric Co. executed the "wheeling agreement" for delivery of power, reports a saving of $19,501.85 or 46 percent of previous charges under private company rates.

The low-cost Reclamation power was delivered to the irrigation district by the Pacific Gas and Electric Co. over P. G. and E.'s lines under the agreement. The West Side District has a 9-year contract with the Bureau which began in June 1951.

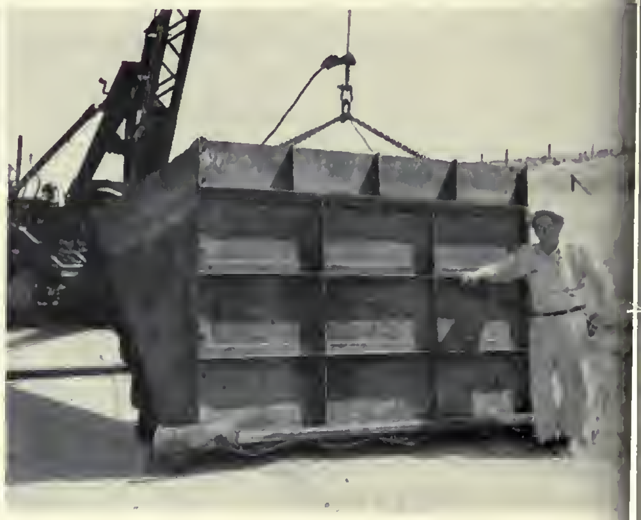
Under terms of the District's contract, P. G. and E. specifies the delivery of 1,500 kilowatts of power over its lines. During the year ending August 1952, the district received almost 5 million kilowatt hours of electricity for which it paid at a rate of 3.62 mills per kilowatt-hour. •

EASY TO ASSEMBLE.—A Contra Costa maintenance crew assembles the newly developed cofferdam in a short time, to meet an emergency

CONTRA COSTA'S PORTABLE

EASY TO HAUL—The assembled cofferdam fits neatly on a truck (below), for transportation to the repair spot. AT THE SCENE (at right) the cofferdam and its inventor, canal foreman A. G. McIntyre, pause briefly at the canal bank before starting to work.

by W. G. WAGGONE
Personnel Assistan
Sacramento, Calif., Region



Y TO INSTALL—A small crane lowers the coflam into position in the canal (at right). DY FOR THE PUMPS (center) the cofferdam's ›ing sides make a snug fit against the canal ks to keep the canal water out. READY TO —In a few minutes the cofferdam will be ıped dry and the repair crews can start to work.

Repairs and maintenance on the Central Valley oject's Contra Costa Canal in California always ve been something of a headache because of the ique operation of the waterway. Its function · domestic and industrial water delivery necessies a year-around, 24-hour-per-day operation, so ıt work must be done in a full canal.

When there is repair work to be done on headtes, pipelines leading from the canal, canal ling, or leaks, a cofferdam had to be devised so that rvice could continue uninterrupted.

OFFERDAM

Canal Maintenance Foreman Alexander G. Mctyre tried several types but found each to be pensive and time consuming. So the Bureau Reclamation maintenance man set out to design cofferdam which would be suited to the operaon, and save time in effecting repairs. Several ings had to be considered, such as ease of loadg and unloading, handling, erection, disassemy, and effectiveness.

After much study and experimentation, Mr. cIntyre finally came up with a model which led the bill in all respects. For his ingenuity, e Contra Costa Canal foreman has received a eritorious suggestion award, and more impornt, maintenance work on the canal has been acmplished with a minimum of delay and without terruption of water service.

Simplicity and ease of adaptation to any situaon are the keys to Mr. McIntyre's development. he cofferdam, constructed of metal, has a front section 5 by 8 feet. Side sections are built to fit the slope of the canal bank. Added versatility is achieved simply by adding sections, making possible use in a canal of any depth or cross section. If additional weight is needed to hold the cofferdam in place, timbers are placed atop the structure and sandbags are added. # # #

Good Medicine at Medicine Creek

HELP FOR THE HELPLESS and wholesome recreation are provided through the facilities of Harry Strunk Lake behind Medicine Creek Dam in Nebraska. The recreational area where the "benefi carnivals were held in 1951 and 1952 is on the left shor

by N. BETH WOODIN,
Kansas River District,
McCook, Nebraska

MAYBE A SPASTIC CHILD NEVER FIGURED to be a part of the indirect benefits of Medicine Creek Dam in Nebraska.

But on a hot Fourth of July this year, the Cambridge, Nebr., Lions Club sponsored a water carnival to raise money to provide medical care and educational benefits for Harlan Dreher, 13-year-old first born son of Mr. and Mrs. Albert Dreher of Cambridge. Harlan, a spastic victim since birth, lives with his mother and father, two sisters and a brother on a farm about 3 miles southwest of Medicine Creek Dam. On days when the sun is shining brightly, the sparkle of water pouring over the spillway is an awe-inspiring sight from the Dreher farm. And the dam which Harlan can see from his home is helping him to learn how to walk, talk, and live a normal life.

Medicine Lake is the reservoir formed by Medicine Creek Dam, completed by the Bureau of Reclamation in December 1949. By Act of Congress, the reservoir was renamed Harry Strunk Lake on July 9, 1952 (66 Stat. 480), in honor of Harry D. Strunk, McCook, Nebr., outstanding conservationist and president of the Republican Valley Conservation Association, who was nominated to Re lamation's Hall of Fame in the September 19 issue of the RECLAMATION ERA.

To M. E. Heinz, pastor of the St. Paul's Lut eran Church of Cambridge, of which Harlan's pa ents are members, goes much of the credit for t assistance Harlan will receive. For 8 month Reverend Heinz worked untiringly but unsucces fully in attempts to interest State and nation welfare organizations in Harlan's case. As member of the Cambridge Lions Club, he th brought the matter to the attention of the Cl members and they readily agreed to help Harl by raising money during their annual Medici Lake Water Carnival to send him to the Institu of Logopedics at Wichita, Kans., where he wou receive physical and occupational therapy a speech correction training.

The 1952 carnival, which included boat rac water skiing, and other aquatic events, had ma entries and was a thrilling spectacle to all th who braved the sweltering heat to watch it. A tendance was poor due to the fact that the Four turned out to be an extremely hot day, and t wheat harvest in the area was in full swing at t time. However, although the event was not profitable as had been hoped, Harlan will not deprived of his opportunity. The Lions Club

CARNIVALS FOR CHARITY—M. E. Heinz (insert), pastor of the St. Paul's Lutheran Church of Cambridge, Nebr., and a member of the Cambridge Lions Club, enlisted the aid of the Lions Club in helping a crippled child toward a normol life. Below, part of the 7,000 people who attended the 1951 carnival sponsored by the Cambridge Lions Club, some of the proceeds from which were applied toword Postor Heinz's project this year. *Photos for this orticle by John N. Berg, Region 7 photographer.*

sing money from its treasury carried over from heir successful 1951 water carnival. As a result f the attention called to this undertaking, the ioney supplied by the club is being augmented by onations from private individuals and by the elease of several hundred dollars from the school istrict in which the boy resides, so that he may be ent to the Wichita Institute.

Part of the proceeds from last year's water arnival was used to purchase a resuscitator which s kept at the lake for the use of anyone having eed for it. Already officers of the Club are planing a bigger and better carnival for 1953, the proeeds to go for some other worthy cause not yet etermined.

The Cambridge Lions Club is to be congratlated on the unusual use they are making of Harry Strunk Lake. In addition to sponsoring vents that attract sportsmen and spectators from ll over Nebraska and the surrounding States, they re playing a Good Samaritan role in raising ioney to assist those who, like Harlan Dreher, eed help.

# # #

Christmas Shopping Problems? Make It an Xmas ERA

Avoid shopping in crowded stores, or thumbing through moil-order catalogs. Give a subscription to the *Reclamation Era* for Christmas. Bureau employees and members of water user organizotions will be entitled to the special subscription rate of $1.00 per year for each gift subscription they purchase. Just send your remittance, made payable to the Treasurer of the United States olong with the loose subscription blank in this issue, to the Commissioner, Bureau of Reclamation, Washington, D. C. Fill in your name and send the name and address of the person to whom you desire the magazine sent and we will be glad to send them a special gift certificate with your name inscribed on it. Through the *Ero* the friend or relative you select will receive o year-round reminder of your thoughtfulness ot Christmas—12 up-to-date, informative issues of the official Bureau of Reclamotion magozine.

Should you desire to purchase more than one subscription just write the word "over" at the bottom of the blonk, and fill in the additional names and addresses on the reverse side.

CORRECTIONS, PLEASE. In the October issue, three errors appeared in the article entitled "Touring South Dakota's Oases" on page 233. Item 1 should have read, "the first *two* cuttings of irrigated alfalfa which ran 4.5 tons per acre." Item 2, should have read "Ten acres of mixed legume and tame grass pasture plots which remained *in excellent condition* after 24 head of cattle grazed on it through the summer, and gained 300 to 400 pounds *per acre.*" Item 4, and the legend for the photograph should have read "23 tons of cabbage per acre grown on the Redfield plots," instead of 30.

Six Loads to Shoulder

(Continued from page 277)

enough to require the fullest measure of effort from everyone.

Therefore I am going to propose a six-point program for getting more local participation from our stockholders. If anyone wishes to add a few more points, I will be very glad to accept any and all collaboration—particularly when accompanied by some real performance.

I have noticed that most of the talk about local participation deals with who wants to be boss, but very little of it deals with who wants to do the work. Yet we cannot have more local control without also having more local responsibility. So under the six-point program, control is assigned squarely on the basis of tasks performed and responsibilities discharged. Control assigned on any other basis would be fictitious and mischievous, would not be tolerated, and could not endure under our democratic processes.

POINT ONE IS WATER RIGHTS. State and local bodies can, should, and must put forth greater and more purposeful efforts in straightening out water rights, always prerequisite to authorization.

In more than one area, water-rights disputes are like a tangle of barbed wire in the path of progress. There is little the Federal Government or the Bureau of Reclamation can or should do by itself to solve this question. It is a matter in which the States and localities have asserted jurisdiction which Reclamation has always recognized.

Respect for State law has been basic in Reclamation since 1902, but we must know what State law is and to whom the water belongs. Here is a load to shoulder.

POINT TWO IS RIGHTS-OF-WAY. No development, even with a clear water right, can be built without procurement or easement of rights-of-way for reservoirs, canals, and transmission lines when land is in private ownership. In many of our projects our local partners acquire and turn over all necessary rights-of-way, which, after all, are required solely for their benefit.

Reclamation has been trying to get localities into such work for a long time. Now we repeat: Here is a load to shoulder.

POINT THREE IS PROJECT PLANNING. There is plenty of work for everybody in this field. State reconnaissance programs, like those of Wyoming or New Mexico, are a great contribution to everyone in the water-resource picture.

The United States Government and the Bureau of Reclamation have encouraged State and local work on these lines for years. Most Reclamation projects were perfected from such local planning initiative. There is still much work to be done.

POINT FOUR IS REGIONAL DEVELOPMENT PLANNING. States and localities, singly or in groups, have a vital and indispensable responsibility for planning the uses to which all waters are to be put, regardless of State lines. This is true not because of any Federal versus State viewpoint, but simply because water insists on running downhill and rivers are notorious for ignoring political boundaries. So it is largely up to the States to decide where, when, and how the regional water resources of the West shall be applied to the soil, the minerals, and the industries of the West. The better that job is done, the better the Federal program can be built to fit your plans.

The States and localities must use, in the most realistic, purposeful, sincere, and constructive way, all the tools available to them—compromise, adjudication, ingenuity, and vision. They must seek not only to apportion the waters now available, but most of all, to find and develop new supplies from waters now wasting unused to the sea. In the last analysis, no one else can do this planning for them; and no criterion, no argument, no justification which does not lead to a full and successful solution of the problems can be accepted.

The States, with Federal encouragement, have been exploring this field for years—at least since the meetings in 1920 and 1921 which led to the Colorado Compact, on which various conflicting interpretations are placed today. Now we repeat: Here is a load to shoulder.

POINT FIVE IS PROJECT OPERATION. Every time that Federal Reclamation is compelled to continue operating a distribution system beyond the development period, your Government is compelled to divert, money, time, and energy which should be spent in planning and building more projects, away from that vital task.

That is why Federal Reclamation has to date 100 contracts under which 88 completed projects or project units have been turned over to water users for operation.

We Reclamation bureaucrats have been trying with considerable, but still incomplete, success to get out of the irrigation project operating business virtually since the beginning of Reclamation. But we cannot let go of a project until someone else ne local group, is able and willing to take it r—or to assume control.

POINT SIX IS STATE AND LOCAL PROJECT CON-RUCTION. The Federal Reclamation program s established 50 years ago, and is still mained, to build projects which for one reason or other are beyond the resources or authorities of al agencies, States or their subdivisions. Under s program, we have built such developments as over and Grand Coulee Dams, which probably ld have been built by no lesser agency than the vernment of the whole United States. And built other necessary developments which were eded at times when money was scarce and the mands upon local agencies were great.

But Western States have grown enormously in eir resources and capabilities since 1902. As a sult, Utah, Washington, Montana, Wyoming, d possibly a number of other States, have felt le to set up limited water-resource development ograms of their own.

To the extent that States, districts, and other encies can build their own developments, they e the resources of the Federal agency for use ere the need is greater. We ask only that State local programs be accommodated to over-all ans for river-basin development, so that one n's project will not interfere with another man's oject.

Naturally, when the Federal Bureau of Reclaation does build or operate a project, it must do under Reclamation law. Furthermore, since the nerican people have made a considerable investnt through our Federal Reclamation program, of the Bureau have an obligation to see that at we have begun is finished in the way that was ended by the stockholder investors. But we by means insist on doing anything ourselves.

For example, 8 years ago I first heard a group, luding the California State Chamber of Comrce, advocating that the State take over and erate the Central Valley project. I immediately ote California's Governor a letter which the cretary of the Interior signed, saying that was e [1] providing California could pay for the projt and carry the comprehensive plan through to completion under the policies and laws under which the endeavor was first undertaken.

Several Secretaries of the Interior and Reclamation's Regional Director Boke have reiterated the original expression. Now I want to go further and actively ask California to go ahead and assume this responsibility, and proceed in an intelligent and thoughtful manner to buy the project it first planned to build itself anyway.

But we cannot sell off Federal projects without Congressional authority and without a buyer. A California Congressman, Clair Engle, has calculated that it would cost close to 4 billion dollars in the next 50 years to buy the existing CVP works and complete the comprehensive Central Valley plan. Then he asks whether the State could carry that load and whether it can let its water and power development wait, and answers each question in the negative. But that is a matter for California to decide.

Reclamation is in earnest about local control and responsibility. And if the 16 other Western Reclamation States are as serious as we are about local control, you will be right there with us before Congress supporting the proposal. For with CVP off our Federal budgets, there will be, by subtraction arithmetically, more of the limited National Reclamation funds available to develop your States.

Here's a real load to shoulder. # # #

[1] The Ickes-Warren letter of March 7, 1945, read: "If the State s arrived at a financial position where it is ready to reimburse United States Treasury for expenditures already made in half of the people of California, and is further prepared to arantee the additional financing necessary to complete the oject within a reasonable number of years, the Department of Interior is prepared to withdraw from the project. Before hand back these responsibilities to the State, however, we feel at sufficient evidence should be presented to prove the willingss and ability of Californians to shoulder the burdens of this eat enterprise."

Domestic Water for the Columbia Basin

(Continued from page 279)

they must hire the well drillers and carry on the operations themselves.

Operating as a group starts more smoothly with legal counsel. John Baird, a local attorney in Ephrata who helped the first group to organize, has listed the numerous things the group must actually do for themselves to secure the benefits of an incorporated water association.

The attorney prepares articles of incorporation. The members sign these in triplicate. These are then sent to the secretary of state in Olympia. After approval he returns one copy for the group and one copy for filing with the county auditor at Ephrata. Members authorize an application for loan funds, usually to the Farmers Home Administration.

The F. H. A. engineers then prepare preliminary specifications. The attorney uses these specifications to secure, through legal procedures, franchises, easements, and road or lateral crossings. The attorney helps the group fill out the numerous application forms required by the F. H. A.

The group of settlers must also obtain a deed to the well site, 100 feet square, from the owner of the land on which the well is to be placed. This land must have a title guaranty report also.

Permits must be secured from the Department of Conservation and Development of the State of Washington through application for groundwater rights. The group also usually needs legal help in securing bids for the construction of the system. In some cases the bid figures may exceed the loan funds and in this case the bids must be rejected and often the members then do a large share of their own work.

One of the important outcomes of this group activity is the community spirit developed between neighbors who are planning to make their future homes together.

Within 6 months of the delivery of the first irrigation water to the Columbia Basin, we find that 9 groups are now producing water for over 50 farm units. Another 11 groups have completed their organization and are either drilling or waiting for their loan funds.

The real significant figures are that now 62 more groups, representing 730 farm units, are in the first stages of becoming acquainted with their neighbors so they can benefit from cooperation by getting cheaper water. A course in orientation, with co-op organization and counseled operation brings drinking water to the desert. # # #

Research Scientists Invited to Participate in Saline Water Conversion Program

All organizations or individuals interested in developing methods of converting sea water and demineralizing brackish water for beneficial uses, are being invited to participate in the initial phase of the program authorized by the Eighty-second Congress through Public Law 448, by the Office of Saline Water Research Coordination, Department of the Interior, at the direction of Secretary Oscar L. Chapman.

The objective of the current program is to coordinate and stimulate research and development of economically feasible processes by which saline waters of all kinds may be made useful for municipal, industrial, irrigation and livestock uses. The first phase of the program quite necessarily consists of inventorying past theoretical and practical developments in the field; establishing contact with all persons who might have something to contribute from personal experience, demonstration or research.

A preliminary brochure is being distributed to universities, research institutions, industries, and individuals known to have active interest in this work. The brochure outlines very briefly the possible physical, chemical, and electrical processes or phenomena necessary to conversion of saline waters into fresh water, together with energy sources which might be used or developed for this purpose. Also included are some of the technical considerations and a somewhat extensive bibliography. The brochure will serve as a starting point for the collection of additional information and the evaluation of new proposals in which the Federal Government may see fit to participate.

Assistant Commissioner of Reclamation, Goodrich W. Lineweaver, designated by Secretary of the Interior Oscar L. Chapman as his representative to head this Department's saline water program, is inviting all educational institutions, foundations, industrial concerns, individuals, and government agencies, State and National, which have previously done some work in this field or have a genuine scientific or related interest in the program problems, to present any constructive suggestions they may have to offer.

Current research funds appropriated by the Congress are severely limited. However, information is available as to the manner in which applications may be made for grants or contracts with which to conduct, or primarily to assist in research in one or more fields of activity. While it will not be possible after evaluating the proposals to provide sufficient funds for even the anticipated top priority group, every effort will be made to inform sources of private capital or privately financed foundations of meritorious proposals which cannot be financed from available congressional appropriations.

Although several hundred inquiries have been received, Davis S. Jenkins, research coordinator of the program, expresses the hope that any who have not already made their interest known will do so by writing the Department of the Interior.

Last Concrete Poured at Hungry Horse

On October 4 the last concrete was poured in ungry Horse Dam, 564-foot-high concrete bulirk located on the South Fork of the Flathead ver in Montana. The giant multipurpose strucre was completed nearly 1 year ahead of schedule d was dedicated by President Truman only 3 ys before the last concrete was poured.

A total of 3,100,000 cubic yards of concrete was ured in the dam during the 4 years of high speed nstruction to meet the power shortage in the rthwest. Many records were set during the uring, including more than 206,000 cubic yards r month for a 6-month period, and 9,000 cubic rds in 1 day. At the time of the dedication, on tober 1, the first 71,250 kilowatt generator went the line. Three others will be installed in the werhouse, the second on December 1 of this year, d the third and fourth scheduled for operation August and November 1953 respectively.

Completion of the dam to its full height this year eans the entire capacity of the 3,500,000 acreot reservoir will be available during the 1953–54 water storage season and the full power and od control benefits will be realized a year earlier an planned. •

"Hap" Parker Retires After 42 Years' Service

H. A. Parker, District Manager for the million-acre Columbia Basin project in Washington State, will retire December 20, 1952, after 42 years' service with the Bureau of Reclamation. He will be succeeded by P. R. Nalder who has served as his assistant.

Mr. Parker, a native of Maine, who received his B. S. degree in civil engineering from the University of Maine in 1909, started working for Reclamation on the old Fort Peck project in Montana that same year, and worked on many Bureau projects during the ensuing years including Montana's Milk River and Lower Yellowstone projects and Wyoming's Shoshone project before coming to Ephrata, Wash., headquarters of the Columbia Basin project.

Mr. Nalder is the second oldest employee in length of service on the Columbia Basin project, having arrived in 1933 prior to the formal ground breaking for Grand Coulee Dam. A native of Washington State, Mr. Nalder received his B. S. degree in electrical engineering from Washington State College in 1933. Mr. Nalder also served on the Commissioner's staff in Washington, D. C. •

NOTES FOR CONTRACTORS

Contracts Awarded During October 1952

ication o.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
09	Eklutna, Alaska	Oct. 10	One 5,000-kilovolt-ampere transformer with three 9,000-volt lightning arresters for Palmer substation, schedule 1.	Westinghouse Electric Corp., Denver, Colo.	$35,754
37	do	Oct. 24	Two 115,000-volt circuit breakers for Eklutna switchyard, schedule 1.	Brown Boveri Corp., New York, N. Y.	40,432
42	Davis Dam, Ariz.-Nev.	Oct. 17	Two 14,400-volt circuit breakers for Phoenix substation, schedule 1.	do	26,162
0	do	do	Four 5,400-kilovolt-ampere reactive power capacitor equipments and six 12,470-volt lightning arresters for Phoenix substation, schedules 2 and 4.	General Electric Co., Denver, Colo.	152,222
61	do	Oct. 24	One 10,500-kilovolt-ampere reactive power capacitor equipment for Cochise substation.	Line Material Co., Milwaukee, Wis.	83,115
774	Columbia Basin, Wash.	Oct. 10	Miscellaneous installations of pipe insulation and pipe heating circuits for Grand Coulee pumping plant.	Bennett and Todd, Coulee Dam, Wash.	15,157
777	Provo River, Utah	Oct. 16	Construction of earthwork and structures for improvement of a 10-mile reach of Provo River channel, Jordanelle to Deer Creek reservoir.	Gibbons and Reed Co., Salt Lake City, Utah.	168,332
780	Columbia Basin, Wash.	Oct. 2	Construction of a selected earth blanket for Potholes East canal.	Otis Williams and Co., Kennewick, Wash.	402,262
782	Tucumcari, N. Mex.	Oct. 17	Construction of earthwork and structures for 4.9 miles of surface drains 3 and 6 near Tucumcari, N. Mex.	Miller and Smith, Albuquerque, N. Mex.	71,951
783	Missouri River Basin, S. Dak.	Oct. 14	Construction of Pactola Dam	Adler Construction Co., Loveland, Colo.	4,246,380
784	Central Valley, Calif.	Oct. 17	Construction of 4.8 miles of earthwork, pipeline, and structures for farm-delivery extensions and additional sublaterals, Ivanhoe irrigation district, Friant-Kern canal-distribution system.	Concrete Conduit Co., Lindsay, Calif.	79,440
786	Missouri River Basin, S. Dak.	Oct. 8	Four 2-foot 9-inch by 2-foot 9-inch high-pressure gates for outlet works at Pactola dam and dikes.	Monarch Forge & Machine Works, Portland, Oreg.	36,600
787	Central Valley, Calif.	Oct. 16	Nine 11-foot 4-inch by 13-foot 5-inch bulkhead gates, one lifting frame, and one lot of bulkhead gate seats, guides, and latches for Folsom power plant.	California Steel Products Co., Richmond, Calif.	35,388
788	do	Oct. 29	2 governors, complete with pumping equipment and auxiliaries, for controlling speed of 9,400-horsepower hydraulic turbine for Nimbus power plant.	Pelton Water Wheel Co., San Francisco, Calif.	75,000
791	Boulder Canyon, Ariz.-Calif.-Nev.	do	Metal partitions, doors, railings, and structural and architectural metalwork for units A3, A4, and A9, Hoover power plant.	Macri & Hood Iron Works, Oakland, Calif.	34,446

NOTES FOR CONTRACTORS—Continued

Contracts Awarded During October 1952—Continued

Specification No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DC-3796	Central Valley, Calif	Oct. 17	Construction of radial gate checks on the Friant-Kern canal, schedule 3.	Young & Smith Construction Co., Salt Lake City, Utah.	$173,11[illegible]
DC-3803	Columbia Basin, Wash	Oct. 29	Completion of river channel slope protection on the Columbia River at Grand Coulee Dam.	Pacific Bridge Co., San Francisco, Calif.	267,50[illegible]
DC-3806	Central Valley, Calif	Oct. 30	Construction of 0.55 mile of Camp Creek tunnel with 7-foot diameter horseshoe shaped section, schedule 2.	G. L. Tarlton Contracting Co., St. Louis, Mo.	412,65[illegible]
DC-3807	San Diego, Calif	do	Construction of steel siphon and structures for San Diego aqueduct's second pipeline, San Luis Rey River crossing.	P. & J. Artukovich, Inc. and M. Miller Co., Los Angeles, Calif.	671,38[illegible]
DC-3809	Paonia, Colo	do	Construction of earthwork and structures for Fire Mountain canal extension.	A. F. Burkhard, Hotchkiss, Colo	51,5[illegible]
117C-158	Columbia Basin, Wash	Oct. 17	Modification of Pasco 6.2 relief pumping plant	J. G. Ungercht and Associates, Pasco, Wash.	11,25[illegible]
117C-164	do	Oct. 8	Cut-off walls and miscellaneous construction on Main, West and East Low Canals.	Stidham Bros., Inc., Ephrata, Wash.	14,8[illegible]
200C-211	Central Valley, Calif	Oct. 1	Electrical distribution system for Mowry and Columbia pumping plants.	Collins Electrical Co., Stockton, Calif.	13,24[illegible]
200C-217	do	Oct. 24	Graveling road, mile 5.57 to 88.60, Delta Mendota Canal	H. Sykes, Patterson, Calif	26,2[illegible]
600C-102	Missouri River Basin, Mont	Oct. 14	Fire station, shop building and 5-car storage garage at Tiber Dam Government camp.	F. L. Flynn & Co., Billings, Mont	33,8[illegible]
600C-105	do	Oct. 27	Construction of caretaker and operating houses for Missouri Diversion Dam, schedule 1.	Borgan Construction Co., Billings, Mont.	36,7[illegible]
602C-14	Missouri River Basin, S. Dak	Oct. 23	Riprap protection of the channel at the outlet of the service spillway, Shadehill Dam, S. Dak.	Virgil R. Jensen, Mobridge, S. Dak	12,47[illegible]
703C-279	Kendrick, Wyo	Oct. 6	Check structure, Casper Canal, station 219+50 and drain inlet, Oregon Trail inlet.	F. L. Flynn & Co., Billings, Mont	22,9[illegible]

Construction and Materials for Which Bids Will Be Requested by February 1953

Project	Description of work or material
Boulder Canyon, Calif	Construction of a 134-acre-foot capacity equalizing reservoir, and overflow weir-type inlet and outlet structures on Unit 8 of Coachella distribution system adjacent to Coachella canal, southwest of Indio, Calif. The outlet structure will have a slide gate for draining tho reservoir.
Buffalo Rapids, Mont	Construction of additional drains for the project's first and second divisions, about 20 miles east of Miles City, Mont.
Central Valley, Calif	Sly Park Dam, part of the American River Basin development, involves construction of an earth- and rock-fill dam about 750 feet long and 175 feet high, with an outlet works conduit and ungated spillway; and construction of a saddle dam about 700 feet long and 100 feet high, on Sly Park Creek about 10 miles from Camino, Calif. Total volume for dam and saddle dam will be about 1,100,000 cubic yards.
Do	Construction of the north section of Madera distribution system's Unit 3 near Madera, Calif., comprises 13 miles of unlined or earth-lined laterals of 6- to 12-foot bottom width and 187 c. f. s. initial capacity.
Do	Construction of 64 miles of 12- to 69-inch diameter reinforced concrete pipe line, monolithic concrete moss screens, the 170 c. f. s. capacity outdoor-type pumping plant D-3, and other smaller pumping plants and highway and railroad crossings for Unit 2 of Delano-Earlimart irrigation district distribution system on Friant-Kern canal located in Tulare and Kern Counties near Delano, Calif.
Colorado-Big Thompson, Colo.	Construction of 13.8-kv. distribution and control line in the Foothills South Area near Loveland, Calif.
Columbia Basin, Wash	Construction of 85 miles of Area E-5 laterals, sublaterals, and wasteways varying from 350 to 2 c. f. s. capacities, near Warden, Wash. Work consists of 73 miles of unlined laterals and wasteways of 2- to 10-foot base width, 12 miles of 12- to 60-inch diameter precast concrete pipeline, concrete structures, and 3 small pumping plants.
Do	Vertical-shaft, motor-driven pumping units of the following capacities for Lateral Area P-9 on Potholes East canal: One 2 c. f. s. at 16-foot head, one 2.3 c. f. s. at 18.5-foot head, one 3.3 c. f. s. at 13-foot head, one 2 c. f. s. at 10.5-foot head, one 6 c. f. s. at 29-foot head, and two 6.3 c. f. s. at 14-foot head. Also required are 3 horizontal centrifugal-type, motor-driven pumping units, each 24 c. f. s. at 50-foot head, for Eltopia Branch pumping plant.
Do	Construction of a small concrete block building and erecting a 60-foot wood-pole antenna for radio communications, near Othello, Wash.
Do	Drilling water supply wells for ditchriders' sites, 1 each in lateral areas W6A and W7 and Babcock pumping plant, all near Quincy, Wash., and 1 in the E4 Area in the vicinity of Moses Lake, Wash.
Columbia Basin, Wash.—Continued	Construction 2 three-bedroom and 1 two-bedroom permanent-type wood frame honses, 3 doub[illegible] garages, 1 pump house, and streets and utilities for ditchriders housing, lateral Area P-8 near Eltopia, Wash.
Do	Furnishing and planting lawn shrubs and trees and furnishing and installing materials and equipment for lawn sprinkler systems at Royal and Eltopia operation and maintenance headquarters.
Do	Painting equipment in Grand Coulee right switchyard and interior painting of metalwork an[illegible] equipment in Grand Coulee pumping plant Installation of 20,500 feet of rubber joint stri[illegible] in both right and left powerhouse.
Do	One 230-kv. disconnecting switch for Gra[illegible] Coulee 230/287-kv. switchyard.
Davis Dam, Ariz.-Nev	Additions to Cochise substation involves installation of 10,500-kvar. shunt capacitor; erection [illegible] 69-kv. bay; and installation of 69-kv. circuit breaker and other equipment. Additions t[illegible] Phoenix substation involves installation of two 21,600-kvar. shunt capacitors and two 14,400-volt, 2,000-ampere, circuit breakers and other electrical equipment.
Do	Erecting steel structures and mounting 161-kv. buses and switches for Buckeye substation near Buckeye, Ariz.
Davis Dam and Parker Dam Power, Ariz.-Nev.-Calif.	Construction of 10 dwellings and 30 one-car garages at Parker Dam Government camp at Parker Dam, Calif.
Gila, Ariz	Construction of 22 miles of unreinforced concrete lined laterals and sublaterals of 45 to 15 c. f. s. capacities for Unit 4 of Mohawk distribut[illegible] system near Wellton, Ariz. Concrete stru[illegible]tures include turnouts, checks, drops, siphons culverts, and lateral turnouts. About 17,0[illegible] cubic yards of excavation for laterals is required
Do	Construction of 2.4 miles of 220 c. f. s. capacity Dome canal and 2.6 miles of 100 c. f. s. capacity lateral D-1.4E, near Dome, Ariz. Structu[illegible] on Dome canal will include river siphon, ro[illegible] siphon, radial gate check, 3 bridges, 2 constan[illegible] head orifice turnouts with capacities of 100 an[illegible] 60 c. f. s., and 8 slope-type turnouts of 15 c. f. [illegible] capacities. The open distribution system w[illegible] serve about 12,000 acres.
Do	Two 1,100-hp., 257 r. p. m., unity power factor 4,160-volt, vertical-shaft motors with direct connected exciters for Wellton-Mohawk pumping plant No. 1; two 3,000-hp., 277 r. p. m., 0.8 leading power factor, 4,160-volt, vertical-shaft motors with direct-connected exciters for Wellton Mohawk pumping plant No. 2; and one 1,850-h[illegible] 277 r. p. m., unity power factor, 4,160-volt vertical-shaft motor with direct-connected ex[illegible]citer for Wellton-Mohawk pumping plant No. [illegible]

Construction and Materials for Which Bids Will Be Requested by February 1953—Continued

Project	Description of work or material
drick, Wyo.	Constructing 6,000 feet of extension to open lateral 256 and concrete structures, and constructing a wasteway structure in Natrona County 4 miles southwest of Casper, Wyo.
dle Rio Grande, N. Mex.	Improvement of about 7 miles of low-flow channel of the Rio Grande near Bernardo, N. Mex., includes clearing of floodway and excavation of pilot channel.
ouri River Basin, Mont.	Crow Creek 100 c. f. s. pumping plant to be constructed about 4 miles southwest of Toston, Mont., on the Missouri River, will lift water from the river an average of 176 feet through a 1,000-foot long, 52-inch inside diameter steel pipe discharge line to Toston tunnel for gravity flow to Toston and Lombard canals. The indoor-type plant is to have a reinforced concrete substructure and a steel superstructure 23 by 60 by 25 feet. The contract is to include installing three 33.3 c. f. s. pumps driven by 900-hp. motors and an 8-ton single I-beam manually operated crane.
Do	Construction of 0.4 mile of a 4,160-volt distribution line to the Crow Creek pumping plant about 4 miles south of Toston, Mont.
Do	Three 32- by 20-foot radial gates and hoists for Tiber Dam.
Do	Two 7- by 12-foot slide gates for Tiber Dam.
Do	A 60-ton traveling crane for Little Porcupine power plant at Missouri diversion dam, 4 miles south of Toston, Mont.
ouri River Basin, Nebr.	Construction of Bartley diversion dam, a concrete overflow weir 1,100 feet long and 3 feet high above river bed, on the Republican River near Indianola, Nebr., will require steel sheet piling cutoffs, a sluiceway, and canal headworks.
Do	The second section of Franklin canal near Franklin and Riverton, Nebr., requires construction of a 13-mile unlined reach of Franklin earth canal of 210 to 140 c. f. s. capacity and 14 to 12 foot bottom width.
ouri River Basin, N. ak.	Raising about 1 mile of the Buchanan road and constructing a timber bridge in the Jamestown reservoir area near Jamestown, N. Dak.
Missouri River Basin, S. Dak.	Second stage construction of the Huron, Sioux Falls, Watertown, and Mount Vernon substations will consists of placing concrete footings and installation of power transformers, autotransformers, and related switches and oil circuit breakers to convert 69-kv. operation to 115-kv.
Do	Second stage construction of the Armour, Beresford, Flandreau, Tyndall, and Woonsocket substations will consist of placing concrete footings and installation of power transformers, autotransformers ranging up to 20,000-kv.-a., and related switches, regulators, and oil circuit breakers.
Do	One air-cooled 10,000-kv.-a., 4,160-volt synchronous condenser for Rapid City substation.
Do	Construction of 115-kv., H-frame, wood-pole transmission lines in the vicinity of Fort Randall Dam as follows: Two parallel 12-mile lines from Fort Randall tap to Fort Randall switchyard; 1.7 mile Fort Randall-O'Neil line extension into Fort Randall switchyard; and 1.7 mile Fort Randall-Winner line extension into Fort Randall switchyard.
Newlands, Nev.	Lining 0.4 mile of U-line canal and 0.1 mile reach of S-3 lateral, near Fallon, Nev., involves furnishing and applying 72 tons of hot asphalt over subbase prepared by others.
Palisades, Idaho	A 6-ton draft tube bulkhead gantry crane for Palisades power plant.
Riverton, Wyo.	Conversion of Pilot Butte power plant to semiautomatic operation.
Tucumcari, N. Mex.	Construction of drain 3-C, about 1 mile long and 4 to 9 feet deep, including 2 culvert road-crossing structures, near Tucumcari.
Vermejo, N. Mex.	Vermejo project rehabilitation under this contract involves construction of earth-fill dams and dikes for the enlargement of three reservoirs and construction of four concrete outlet structures near the Vermejo River about 5 miles northwest of Maxwell, N. Mex.
Yakima, Wash.	Furnishing and erecting a small prefabricated warehouse building and constructing a road near Chandler power plant 9 miles from Prosser, Wash.

United States Department of Interior, Oscar L. Chapman, Secretary
BUREAU OF RECLAMATION OFFICES

Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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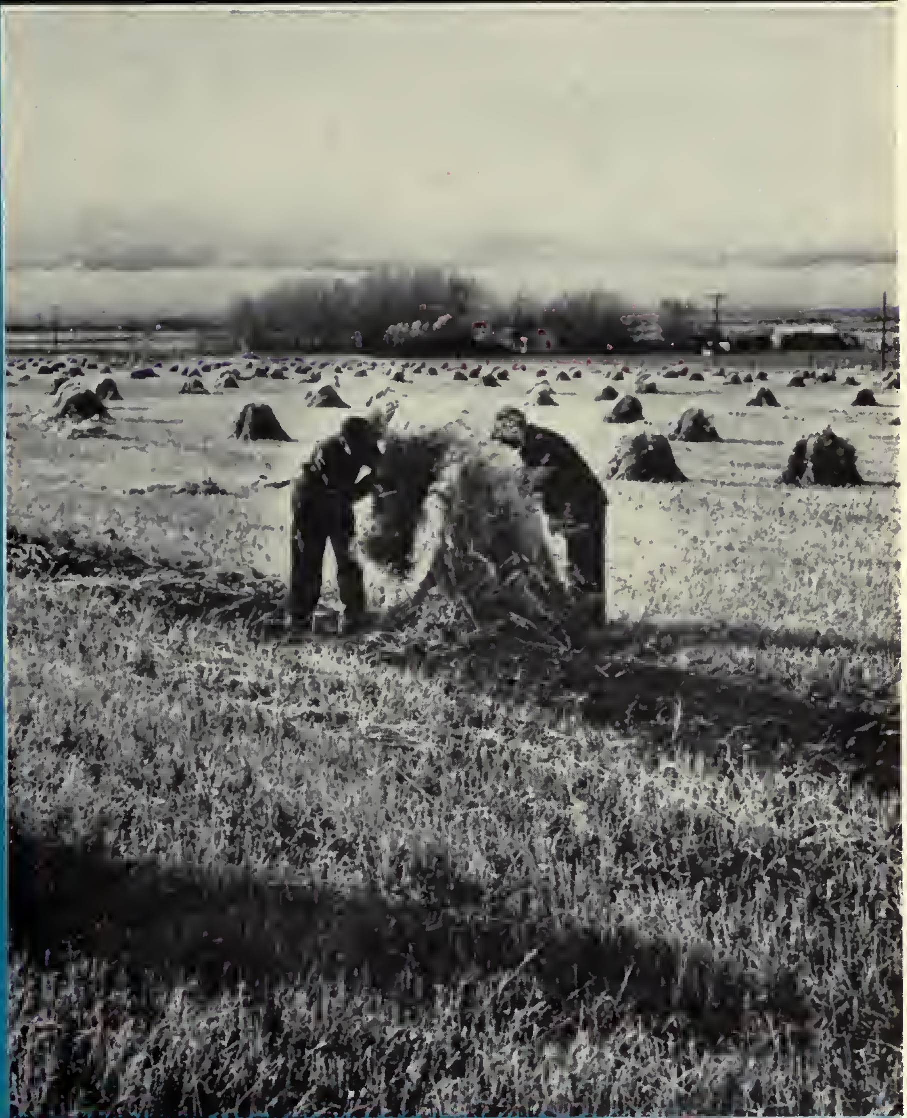
THE RECLAMATION AREA

The Reclamation ERA

Official Publication of the Bureau of Reclamation

January

1953



IN THIS ISSUE: IRRIGATION AND WATER QUALITY by C. S. Howard, United States Geological Survey

FRIANT-KERN'S AUTOMATIC GATE TENDER by Jackson T. Carle

January 1953

Volume 39, No. 1

The Reclamation ERA

35 Years Ago In The Era

New Years Greeting to the Reclamation Farmers

The water and the thirsty land have been united. On more than a million acres of reclaimed land you have established your homes and have subdued the desert to profitable agriculture with an annual harvest valued at $50,000,000. During the past year, in response to the President's appeal to the farmers for increased food production, you added 200,000 acres to the cultivated area of your farms, and are now preparing for greater efforts in 1918. Your contributions to the Liberty Loan have been generous. Patriotically and loyally you have given your sons to the cause of democracy.

The Nation has reason to be profoundly grateful for the abundant evidence on every hand of enduring love and service for the cause of liberty. May the New Year bring you a full measure of health and prosperity.

(From the cover illustration of the January 1918 issue of the RECLAMATION RECORD, predecessor to the RECLAMATION ERA.)

OUR FRONT COVER—PEACE AND PROSPERITY are portrayed in this scene of the Sun River project in Montana. Oats and barley are being stacked on Ray T. Ramsey's irrigated farm. Photo by Donald H. Demarest, former Region 6 photographer.

OUR BACK COVER is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners Kittredge and Coolidge.

DESIGN AND ILLUSTRATIONS by Graphics Section, Bureau of Reclamation, Washington, D. C.

R. F. Sadler, Editor

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In this issue . . .

RECLAMATION PLACE NAMES IN THIS ISSUE

WHITE DEPOSIT marking the water line in Lake Mead, con-
ng chiefly of silica and calcium carbonate, represents a small part of the 10,000,000 tons of material precipitated in the lake, offsetting to some extent the salt concentrated in the water.

IRRIGATION AND WATER QUALITY

by C. S. HOWARD, Regionol Chemist

Quolity of Woter Bronch, U. S. Geological Survey

Salt Loke City, Utoh

Part 1—How dissolved solids increase in irrigation water

DITOR'S NOTE: The Bureau of Reclamation has always n deeply concerned with the quality of water used for, l resulting from, lrrigatlon.

Before a project is constructed, Bureau technicians dy the chemlstry of existing water supplies and fore- t future changes which may occur under lrrigation.

f there appear to he problems which cannot he cor- ted, the project may not be built. If remedial measures uld he taken, these are recommended and put into ect.

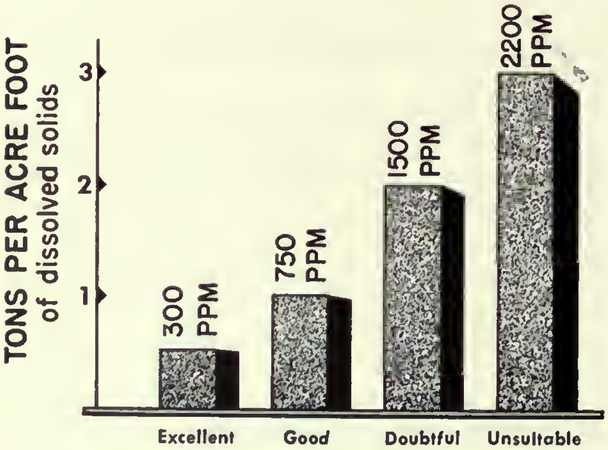
A "Watchdog" program, using the facllities of more n a hundred selected gaging stations over the West, s recently heen organized. Known as the "Water ality Network," thls activity is designed to keep tabs the quality of water and changes which occur in the ers and streams of the West. The Bureau of Reclama- n is cooperating in this program which is under the ection of the Federal Inter-Agency River Basin Com- ttee and operated hy United States Department of the erior's Geological Survey. Other Federal agencies co- rating in the program include the United States De- rtment of Agrlculture, Federal Security Agency's Public alth Service and the Department of the Army's Corps Engineers.

Do YOU HAVE WATER-LOGGED AREAS and alkali spots on your land? How about similar areas and spots on your neighbor's land upstream? The way water is used upstream from your intake, with the possible exception of that used for power development and navigation, has a great deal to do with the quality of water which reaches your farm. The way you use water on your own farm for irrigation may change the water quality in relatively short stretches of a river. Growing plants require large quantities of water, but as they grow they do not use much of the minerals which are dissolved and carried in irrigation water. As a result, these dissolved solids become concentrated in the water which remains unused. Drainage from unimproved and irrigated areas (as desirable as this may be for the lands drained) will increase

TOO MUCH SALT in the soil prevents barley growth. ***Photograph courtesy of the United States Department of Agriculture, United States Regional Salinity Laboratory, Riverside, Calif.***

the dissolved solids content of the stream into which these drainage waters flow.

Water undergoes many chemical changes as it flows along, soaks into the ground, comes into contact with minerals in the soil and dissolves them. All natural waters contain quantities of dissolved solids ranging from the small quantities found in most mountain waters to appreciable quantities found in waters from some wells, rivers, and lakes. Normally the quantities of dissolved solids in natural waters are so small, however, that for convenience these quantities are reported in units of parts per million, that is, the number of pounds of soluble material in a million pounds of water. For irrigation waters the quantities of soluble material are reported as tons per acre-foot of water. As an example of the quantities with which we are concerned it might be said that the Colorado River below Hoover Dam has an average dissolved solids content of 650 parts per million which, expressed in tons per acre-foot, will be 0.88. Another method of expressing this concentration would be to consider that a 55-gallon barrel of clear Colorado River water when evaporated to dryness would leave a residue weighing less than 5 ounces.



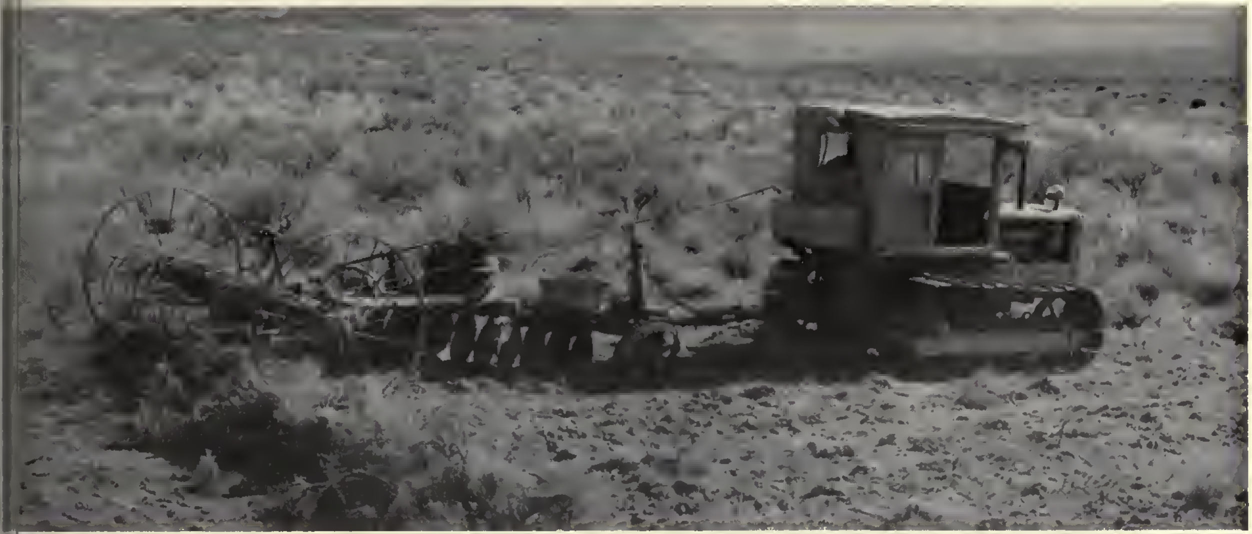
HOW MUCH SOLUBLE SALT CAN MOST IRRIGATED CROPS STAND? *If your irrigation water contains ½ ton of dissolved solids per acre-foot or 300 parts per million), the quality of water is considered "excellent." The chart indicates the progressive standards for water quality considered "good," "doubtful," and "unsuitable." Chart drawn by Graphics Section, Washington, D. C., based upon information contained in United States Department of Agriculture Circular 784.*

Irrigation water is obtained from both surface and underground sources. Surface water is often taken directly from streams, but as the stream flow fluctuates from season to season and is usually lowest when irrigators need water the most, it is desirable to have storage reservoirs from which water can be drawn as needed. Supplies from underground sources are in effect drawing from reservoirs, and when the rate of use from underground sources exceeds the rate of recharge of those reservoirs a water shortage results. Water shortages are troublesome enough, but there is another thing to consider. If you continually pump or use more water than is usually stored beneath the surface, you may start to draw water of a less desirable quality into the underground reservoir.

During storage of surface waters some water is lost through evaporation. For large reservoirs in dry climates this may amount to appreciable volumes of water. The dissolved solids left behind as the water evaporates become part of the dissolved solids already contained in the stored water.

Many reservoirs have been constructed, particularly in the Southwest, in areas where there a

(Please turn to page 4)



DUING SAGEBRUSH is not too tough when a Wheatland disk w rig is used. Here, a defiant stand of sagebrush on the Roza Division of the Yakima project has been transformed into a clean field. *Photo by Stan Rasmussen, Region 1 photographer.*

HE DISK PLOW RIG:
A Handy Weapon in Removing Sagebrush

based on information supplied by
FRANK WEBSTER, County Agent, Prosser, Wash.

SAGEBRUSH CLEARING IS ONE OF THE DIRTIEST, skiest jobs in Reclamation. Farmers are always the lookout for an easy, and—most important—heap method of doing the job. In many parts the West, particularly on the Roza Division Washington's Yakima project, the Wheatland sk plow rig has come into popularity as a weapon ainst the sagebrush because it usually offers ne-saving and cost advantages.

Basically the rig consists of a Wheatland disk ow, hauled by a tractor and towing an ordinary mp rake. The plow slices about two to three ches underground, cutting the crown of the sage f the root. The rake collects the sagebrush into ndrows when tripped by the operator on the actor.

A crawler tractor is best for hauling the rig cause, unlike a wheel tractor, it doesn't slip and g itself in on the steeper slopes. The added wer of the crawler tractor comes in especially ndy when the brush and bunch grass are par- cularly heavy. Large rubber-tired farm trac- rs have been used successfully, however. Often e tractor is equipped with lights for night work.

The Wheatland disk plow used most often on the Roza has 20-inch diameter blades, although a plow with bigger blades works even more effectively. The disks should be kept sharp and set to cut the required 2 to 3 inches underground. If the plow is not heavy enough to cut the desired depths, it can be weighted. Setting the disks too shallow results in leaving some of the brush uncut and leads to the extra expense of going over the area a second time or cutting the sage loose by hand. If the disks are too deep, they will plow much of the dirt over the sage, making it impossible for the rake to pick up the sage cleanly.

Once cut, the brush is no longer a problem. The plant is killed when the crown is cut from the root and the roots are then easily cut by plows or other tillage implements. An easy victim of decay, the root usually disappears completely in two or three irrigation seasons.

The rake used is an ordinary hay dump rake with a stub tongue attached so that it follows obediently behind the plow. A rope is fastened to the dump pedal at one end of the rake and then strung to a convenient place in the cab of the tractor, where the operator can trip the rake by "finger tip" control of the rope. The windrows

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left behind the rig are usually small unless someone rides the rake and holds down the teeth. A disadvantage in weighting the teeth, however, is that it sometimes results in raking a lot of soil into the windrows.

It is wise to point the rows downwind so that later they can be burned quickly and neatly. Most of the Roza farmers found it helpful to cross-rake the area after burning since some of the more wily sage always manages to work free of the rake teeth and sit defiantly out of the windrows beyond the burning area.

Where brush and trash are very heavy and the tractor does not have enough power to handle both the disk and the rake, the clearing can be done in two operations. Generally the rig works best in small, sparse sagebrush, but it is also reported that the Wheatland disk plow rig has worked quite well even in thick, waist-high brush on the Roza. The crawler batters down much of the brush as it passes over, making it easier for the disk to get at the crowns.

Because it can often clean up the sagebrush in one fairly easy operation, the disk plow-rake method cuts costs considerably. Costs on the Roza range from $8 per acre to as high as $15 per acre, depending on thickness of the sage and other factors.

The disk plow and the crawler tractor, best adapted for hauling the rig, are usually to be found anywhere in the vicinity of new irrigation where clearing and leveling is underway. ###

Irrigation and Water Quality

(Continued from page 2)

large quantities of soluable salts in and around the reservoir site. As water rises in these reservoirs the soluble material is leached and the dissolved salts are added to the concentration of minerals in the stored water. Computations for Lake Mead have shown gains in dissolved solids due to solution and evaporation of about 20 million tons of material in the first 14 years of operation. The more easily soluble salts have now been leached and it is likely that the rate of increase in mineral matter from solution will decline in the next few years.

Another process takes place during storage which tends to offset to some extent the increase due to evaporation and solution. This is the precipitation of certain constituents of the water, chiefly calcium carbonate and silica. These minerals settle and do not become part of the dissolved solids in the water. Computations made for Lake Mead indicate that more than ten million tons of these constituents were precipitated during the first 14 years of storage. The white deposit marking the water line in Lake Mead, consisting chiefly of silica and calcium carbonate, represents a small part of the material precipitated in this lake.

The quantity of water used in growth processes varies, of course, for different types of plants, but the annual quantity used averages more than 2.5 feet for each acre of cropped land. Plants use little of the mineral matter of the irrigation water and as a result much of the dissolved material is left in the soil solution or in the soil. Natural or artificial drains must be available to carry these solids out of the root zone to avoid a toxic accumulation of soluble solids. For an irrigation water like the Colorado River below Hoover Dam the annual use of 2.5 acre-feet of water will make available more than 2 tons of soluble salts per acre of irrigated land. Many irrigation waters have more than this quantity of soluble salts so that successful irrigation requires the drainage of some of the water and its increased soluble solid load out of the irrigated area. There is additional increase in dissolved solids content through the use of water by plants growing around the reservoir.

This discussion has shown how large quantities of soluble material may be added to the salt load of a stream through changes during storage and through irrigation practices. Casual observation in any irrigated area will show some deleterious effects of irrigation as evidenced by the presence of water-logged areas or deposits of salts. In the next article information will be presented concerning the quality of waters in various irrigated areas.

###

HAVE YOU CHANGED YOUR ADDRESS LATELY? GOING TO MOVE SOON?

Let us know immediately so we can change our mailing list—it takes time, you know.

We'll do our best to deliver the Reclamation Era at your door, but we have to know where it is.

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CLIFFORD H. STONE
—The man with a mission

by JOHN GEOFFREY WILL
Secretary and General Counsel
Upper Colorado River Commission

"EVERY EXTRAORDINARY MAN," said Goethe, "has certain mission to accomplish." Yet there was thing in his early youth at Powderhorn, Colo., the magnificent Gunnison River Valley, from hich it might have been foretold that Clifford . Stone was the possessor of a peculiar genius iat was to ornament his later years; that he did ideed, have a mission; and that he would comlete the same.

Had we been able to read the signs, the first inication of his extraordinary elements might have en noted when the people of Gunnison elected im County Judge. He was only 24 years of age, robably the youngest County Judge ever elected Colorado, and had had only 1 year of study at ie Law School of the University of Colorado 1911–12). Forever thereafter, he was to be illed "Judge Stone."

He served 8 years as County Judge of Gunnison ounty, managing to perform his duties while rving with the Army and continuing his law udies. Ironically enough, he tried to enlist, was fused on account of his poor eyesight, and was ibsequently drafted into the Infantry in August 918, where again his nearsightedness was noted nd he was assigned to limited service with his cal draft board, being honorably discharged 1 ear later. In the meantime, he managed to reume his law course at the University of Colorado, assed the Colorado Bar exam in December 1920 ith the highest mark accorded to anyone in that xamination, and obtained the degree of Bachelor f Laws in June 1921. He found time also to publish the Gunnison "News-Champion" for a brief period, at one time having wavered between a law and journalism career.

Beginning in June of 1921, Judge Stone engaged in general law practice in Gunnison, carrying on also his duties as County Judge for awhile. During the period between the completion of his 8 years on the Bench and his election to the Colorado General Assembly, he served at various times as County Attorney and Deputy District Attorney. In this latter capacity, he served for 12 years under both Republican and Democratic District Attorneys. It was apparent, even then, as it continued to be throughout his career, that he would not let partisan politics interfere with duty. During the period of his general practice in Gunnison he gained that experience in mining and water law, the former providing the foundation of the latter, which stood him in such good stead in later years.

The people of Gunnison, Sagauche, and Hinsdale counties had, in 1936, elected Judge Stone to a term in Colorado's General Assembly. He never ran for reelection; for his mission came upon him. As a legislator he worked hard to lay the foundation for the wise and imaginative handling of Colorado's internecine water wars. This foundation is technically referred to as "AN ACT—*Relating to the Waters of the State of Colorado, Providing for the Control, Protection, and Development Thereof, and Making an Appropriation Therefor.*" It became law in June of 1937. It has been amended from time to time. Other

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States have produced more or less faithful imitations of it. Its principal purpose was to create the Colorado Water Conservation Board with a membership representative of the State's various river drainage areas, that is to say: the Rio Grande, the North Platte, the Arkansas, the South Platte, the Yampa-White, the Colorado, the Gunnison, Uncompahgre, and the San Miguel-Dolores-San Juan areas. Judge Stone became the first director of that Board, serving in that capacity, through Democratic and Republican administrations, until his death on October 21, 1952.

Protection of States' Rights

The mission to which he was to devote his life, was a peaceful mission that would, in due course, produce great works for Colorado and the West. He wanted peace within Colorado; but he would not to that end sacrifice the destiny of any area. He wanted peace among Colorado and her neighboring States, all dependent to some extent on common river systems; but he would not to that end sacrifice Colorado's interests. Nor would he (and this is revealing) knowingly permit the negotiators of another State unwittingly to yield. He wanted to be sure that they were as fully possessed as he of the facts pertinent to the matter that was the subject of negotiation. He wanted an end to conflict between the States and the Federal Government; but he would not for that sacrifice the integrity of State water laws. He believed that the Western States could achieve great works for the development, conservation and utilization of their water resources by assisting one another and by presenting a united front to the world and, particularly, to Washington. He believed profoundly in the Federal Reclamation program. He would seek always to work with the Bureau of Reclamation and the Army Engineers and to persuade others to do the same. He had no use for those who, holding a brief for some particular interest, worked to subvert the reclamation movement.

Such was the mission set for himself by this extraordinary man. Having become convinced that the best possible means for the settlement of inter-State disputes relating to water lay in compacts, he became the protagonist of that means. The Rio Grande Compact, the Republican River Compact, the Costilla Compact, the Arkansas River Compact and the Upper Colorado River Basin Compact, and others all testify to his effectiveness in the settlement of quarrels or incipient quarrels of which the Supreme Court would, in any event, have been reluctant to take jurisdiction. He was working at the time of his death toward a Missouri River Basin compact and toward some such arrangement on the Arkansas-Red-and-White.

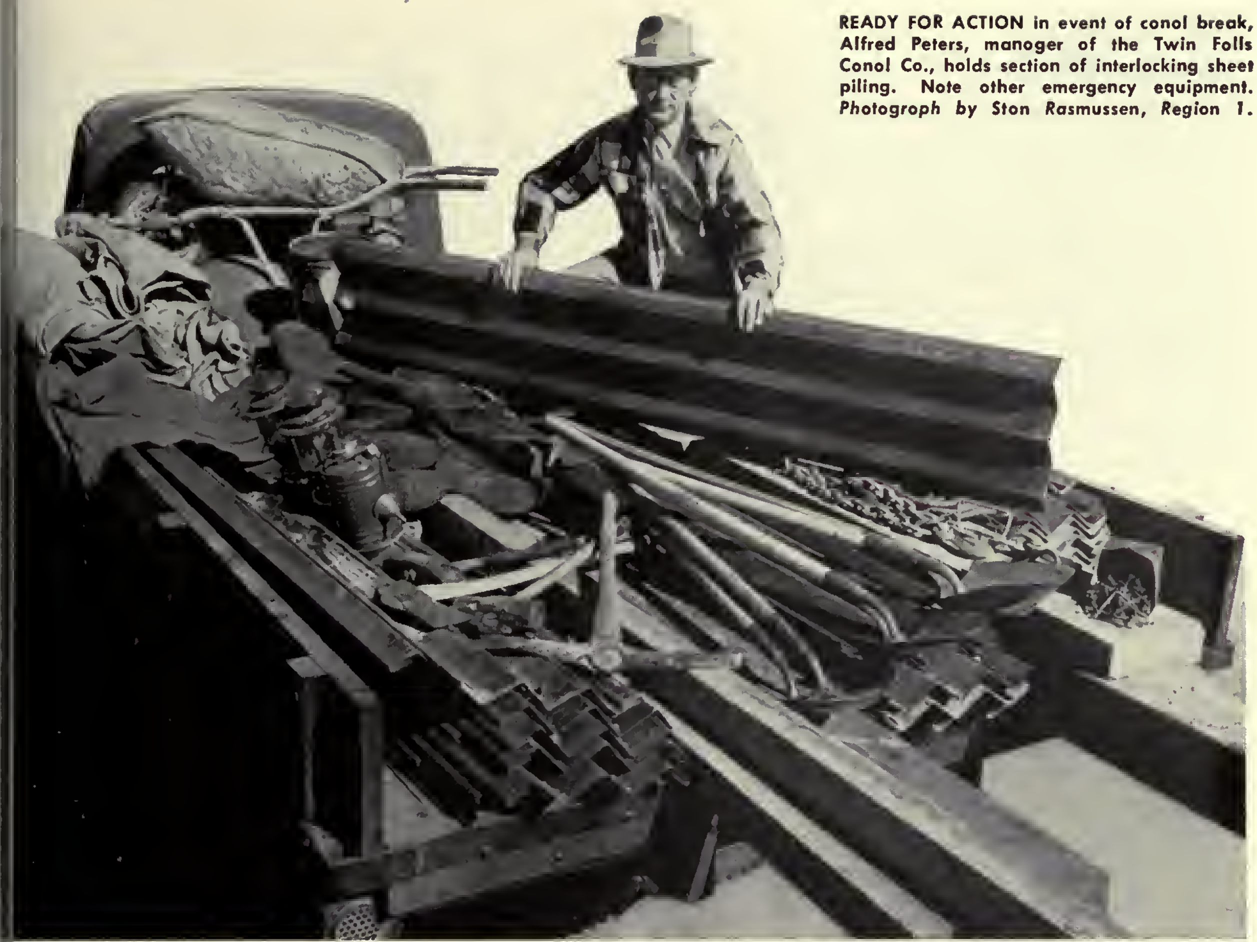
Judge Stone did not always agree with all the agencies with which he cooperated, nor was he blindly inflexible in his opinions. This was demonstrated during his violent disagreement with the Bureau of Reclamation on the policy and practice of using revenues from the Federal Government's investment in the power facilities of Reclamation projects to help pay the cost of irrigation features. The judge drafted a bill to outlaw the practice and waged several battles before congressional committees. The bill was never enacted, and the judge later became convinced of the benefits and legality of the policy in question. He had the courage, rarely found today in public figures, to let his change of mind be known as widely as he had theretofore aired his prior opinion.

Projects for Peace

Early in the year 1951, Judge Stone made an appeal before the House Committee on Interior and Insular Affairs, in behalf of the 17 Western States. Having noted that budgetary conditions might become such, from time to time, as to indicate the need for some retrenchment of domestic expenditures, including expenditures for Reclamation; having asserted that the 17 Western States could and would do their patriotic bit to bear that part of, as he called it, "the bitter fruit of man's apparent lack of ability to wage peace as well as war," he said: ". . . the conclusion is inescapable that you must also build a shelf of authorized projects, both large and small, that can be undertaken during periods of reduced stress. You should have these projects ready to go. . . . In other words we should plan now for peace and, to the fullest practicable extent, we should build now for peace . . ."

On another occasion he exploded before the Secretary of the Interior the myth oft repeated that, once a national monument has been created, it may never ever be considered for uses broader and more beneficial than those originally pro-

(Please turn to page 9)



READY FOR ACTION in event of conol break, Alfred Peters, monoger of the Twin Folls Conol Co., holds section of interlocking sheet piling. Note other emergency equipment. *Photograph by Ston Rasmussen, Region 1.*

n Canal Breaks—SPEED'S THE THING

by DICK LARSEN

Region 1 Headquarters, Boise, Idaho

"A BREAK IN THE MAIN CANAL," rasped the ex-
ed telephone voice.

In his office in Twin Falls, Idaho, Alfred Peters ed quick questions. This break, he learned, was big one. Carrying 3,600 cubic feet of water per cond, the giant canal had burst through its bank ar Murtaugh Lake, 28 miles from town.

When a canal bank gives way it can mean dis- ter. But Peters, manager of the Twin Falls anal Co., a privately built, owned and operated rigation project, had geared his organization to ick action. Within seconds, an emergency uck, driven by Dave Remaly, roared out of the mpany yard. Peters, in his own car, dashed out pick up help. In 20 minutes the truck, its diator boiling, reached the scene of the break. Water was pouring through a 20-foot gap in the canal bank. At almost the same moment Peters and a crew of men arrived.

The first telephone call had been made at 10 a.m. By noon the break was checked and the water was back where it belonged. What could have been a disaster turned out to be no more than a stiff, 2-hours' workout for the crew. They had successfully unleashed a new weapon against the canal break—the emergency truck.

Just a few weeks earlier, it had been loaded with a hodgepodge of gear necessary for such an emergency and had been put on a 24-hour-a-day standby. When it was needed, it was ready to roll.

Key item among the truck's paraphernalia is a collection of $^{3}/_{16}$-inch steel sheet piling, in 4-, 5-, and 10-foot lengths. The sheets, 14 inches wide, with interlocking edges, are sunk one at a time directly across the break, forming a neat cofferdam

STOP GAP WALL made of sheet piling closes canal break. Note lightness of metal as Dave Remaly in the photo at right passes one to Pete Gillespie on the canal bank. ***Photo above, courtesy of the Twin Falls TIMES-NEWS; photo at right by Stan Rasmussen.***

to keep the water within its banks and to permit easy permanent filling. The individual sheets are light enough for two men to handle easily and are driven into place by heavy 12-pound hammers and a 50-pound weight which is carried aboard the truck. The weight is placed atop the sheet piling and then driven down with the hammers. A hole near the top of each piling section permits handling them with a hay hook and is also used to lift them out of the bank later. Commonly used for cofferdams and similar devices, the sheet piling is available from many construction equipment firms. As a bonus benefit, the piling comes in handy in many nonemergency jobs, such as dewatering small areas in front of turnouts for repair of the gates.

Other important items among the truck's collection are a number of 3 x 12 timbers, in about 12-foot lengths, used to form an emergency walkway across the escaping water. One board is tossed out from each side of the break, providing a place for workers to stand while driving the piling. If necessary, 4 x 4's are hauled off the truck to serve as supports for the walkway.

Also aboard the emergency vehicle are rolls of canvas sheeting and bales of burlap bags to be used as bank sealers, and such important miscellany as picks and shovels, a bucket and hammer and nails. Chains and hooks are available for handling the piling and removing it when its work is done. The chains are also available for possible use in case the truck gets stuck. For night work the truck carries a stock of kerosene lamps and— as a neat added touch of prevention—a can of lamp fuel. Of course, the familiar rubber boots are also handy.

The truck happens to be a unique feature of the canal company's operation. The organization is alert in other ways. Manager Peters always has handy in his Twin Falls office a roster showing just where the 3- to 8-man repair and maintenance crews are working at any given time. If a break comes on any part of the company's 202,000-acre tract, the truck is on its way while a car races to the crew nearest the break to recruit manpower. Dave Remaly is ready to hop into the cab of the truck any time of the day or night. Nearly every one subject to night calls carries in his own car a high-powered searchlight which can be plugged into the dashboard lighter socket.

The Murtaugh break was the biggest action in which the truck participated in its first season of operation in 1952. There were other small breaks, any one of which could have become major. The amount of damage which the truck has prevented is inestimable, Peters points out. A small break speedily checked might have otherwise grown into a big one, sending floodwaters racing through valuable farmlands. Quick installation of the sheet piling in the Murtaugh break not only checked the flooding but also made it unnecessary to turn off the water in the canal. That prevent ie farmers' irrigation water from being cut off, hich often does more dollar damage than flood-g. The break happened to be on the uphill bank here the canal crosses relatively flat country. he sheet piling is best adapted to repair of breaks fairly low canals in flat country where the escap-g water does not have a big drop and high locity.

"The key to effectively handling canal breaks is eed", Peters says. "It's just like a fire. Fire en-nes are all ready at any moment an emergency strikes. That's what gave us the idea of having our truck all loaded and ready to go at any moment. Speed's the thing."

And speed is what the Twin Falls company has. But even now it is considering installing radio contact with its field crews to further expedite the operation. The Twin Falls company's concept of speed and its poised 2-ton truck and hodgepodge load may show the way for other water user groups facing the constant threat of the canal break.

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CLIFFORD H. STONE

(Continued from page 6)

osed to be served. He said that adherence to ich absurd doctrine "is contrary to the recognized rinciple of integrated resource development in e maximum attainable degree for all purposes." uch doctrine, he went on to say: "assumes that, hen a national monument is once established, ery phase of the pattern of river basin develop-ent has been explored with unerring skill and ith a clear knowledge of future economic con-itions." "We all know," he said, "that national onuments have not been established in that way."

He was principally honored, not only in Colo-ado, but throughout the West by being saddled ith jobs, the end objective of each of which was achieve the development and protection of Vestern water resources. He had been regional irector of the National Resources Planning oard; he had served, by appointment of the ecretary of the Interior, as mediator in a dispute ivolving certain Arizona irrigation districts; he as chairman of the Basin States Committee and, s such, he played an important role in securing atification of the Mexican Water Treaty; he had een a vice president of the National Reclamation ssociation and was a director of that Association or many years. In that capacity, he could be ound always actively engaged with those mem-ers of the Association who favored continued ncouragement for development of the country's ater resources. He was a member of the Ar-ansas River Compact Commission; a member and ice chairman of the Upper Colorado River Com-ission. He had been designated by the Council f State Governments as a member of a committee f three to draft a proposed compact for the Mis-ouri Basin States. It is impossible, without unduly lengthening this article, to list all of the capacities in which he served his fellow man.

In May of 1952, at ceremonies under the auspices of the University of Colorado chapter, there was conferred upon him honorary membership in the Order of the Coif, a legal fraternity, active membership in which is based upon scholarship. So far as I can determine, this honor and membership has been conferred in Colorado upon only four other men. I remember how deeply moved he was at the recognition thus accorded his public service. An honor which others had perhaps accepted with equanimity seemed to come almost as a surprise to him who had done most to deserve it.

He whose name was a byword in the West and elsewhere, the man thus honored by his fellow men, was charmingly careless for himself. Devotion, consecration, selflessness—these attributes he had in fullest measure. His accomplishments testify to that. The lost hat and coats forgotten in restaurants and meeting halls; the cigarette ashes on his suit at the end of the day—these homely things too are suggestive of a mind at work for others.

The man with a mission has gone forward in the service of Providence. Mission accomplished? Yes—Colorado and the other Western States will provide proof of that accomplishment by reaching prompt agreement within and among them upon questions to the settlement of which he gave his mind, his heart and his life. ###

Errata Note on "Columbia Basin's First Harvest"

In the article "Columbia Basin's First Harvest" which appeared in the November issue of the RECLAMATION ERA, the following corrections were received too late to reach the printer: On page 263, paragraph 2, the correct name is Percy A. Kelly, rather than Paul, and in paragraph 2, Quincy should be changed to Winchester in referring to the $600-an-acre onion crop. On page 264, column 2, paragraph 2, change the acreage figure from 59,558 to 65,692.

ASSEMBLY LINE production methods at left bring a neat profit to Lindo Starr, Orland project farmer. At lower left, a handful of 3-month-old earthworms, ready for shipment to all parts of the country for a variety of purposes: bait, fertilizer, and research.

ORLAND'S FERTILIZER FACTORY

by BRUCE B. BARNUM, Agricultural Aid
Sacramento Valley District, Chico, Calif., Region 2

A BRAND NEW CROP is being grown on the Orland reclamation project in northern California, where a variety of produce from grains to citrus fruits already is the pride of the district. It is the lowly earthworm, raised in commercial quantities on the farm of Lindo Starr at the east end of the 20,000-acre irrigation development.

"Not only do the worms turn a neat profit back to the owner, but they turn back to the soil the most perfect natural fertilizer yet discovered," the enthusiastic Mr. Starr said.

"I'm a relative newcomer to this business of earthworm raising," Mr. Starr said, "just finishing up our second year here, but I had been doing a lot of reading and thinking about it."

Mr. Starr admitted that most of his production goes for sports consumption as bait at the present time, but that he is encouraged by the increasing demand for breeding stock. In addition there is a need for worms by laboratories, researchers, and others who are interested in organic gardening.

Although worm production is a business more or less unique at this time, it resembles some factories in that an assembly line is necessary. It takes the form of a long wooden counter, where spot checks of each shipment are made to determine proper count, size, and food and moisture content of the packing material in each box. The small packing boxes are made from lumber scraps.

"The peat moss we use for packing material must have sufficient food and moisture to last until the shipment arrives at its destination," Mr. Starr pointed out. "Once, on a very hot day I received a call for help from the postmaster. Heat had forced the worms to escape through the air holes and they were all over the postoffice."

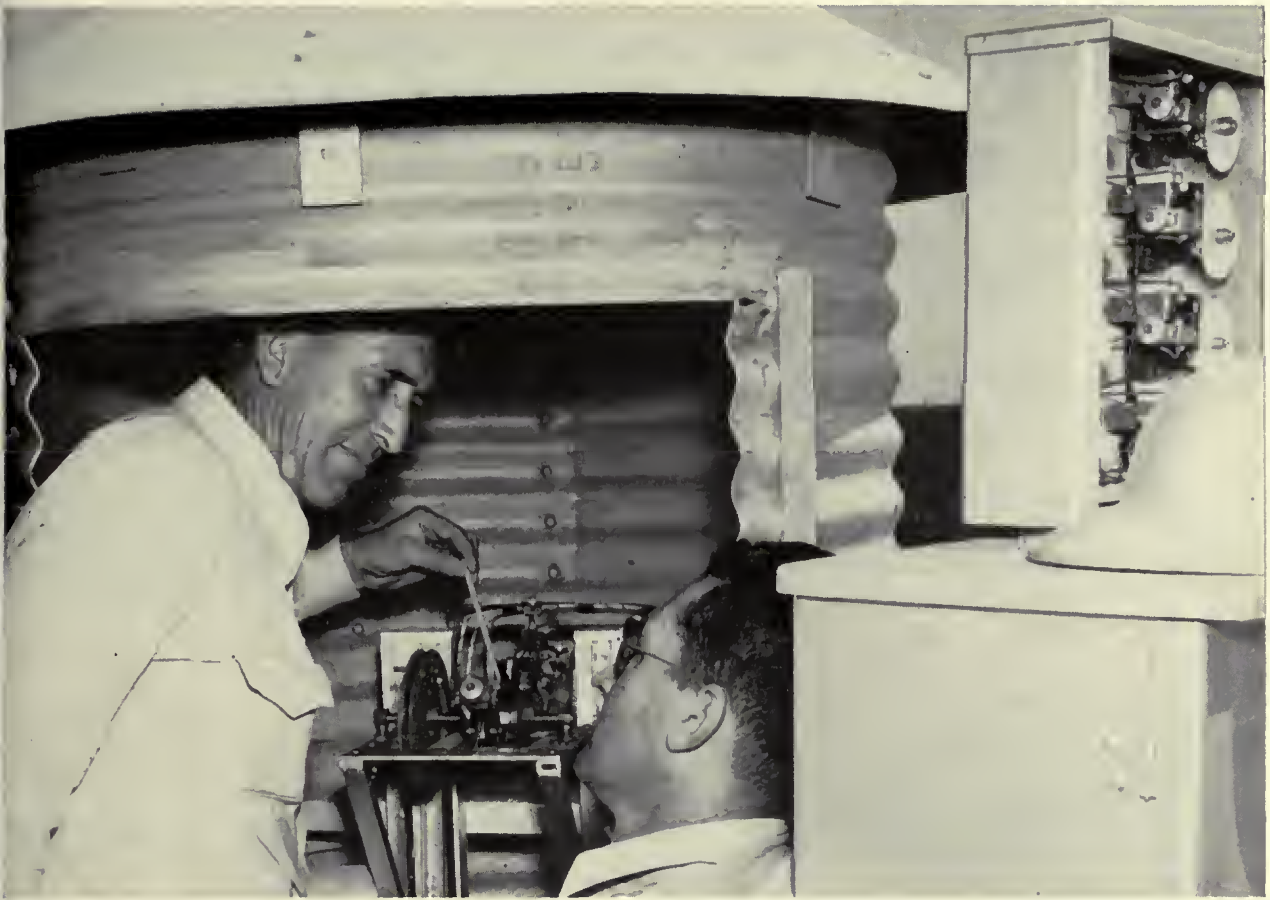
Does a worm farm pay? You bet it does. During a peak month last summer the Starr enterprise grossed $6,000 from worm shipments alone. Added to this are such items as organic fertilizer and gardening gadgets.

"There are lots of angles to this business," the Orland farmer said. "For instance many people have asked me how the worms are kept confined in the beds without high sides or concrete bottoms. It's simple. Just keep them comfortable where they are and there won't be any wandering worms.

"They seldom stray far from food, darkness and moisture, and if by chance they do go wandering, we just turn on the lights and run them back to their corral. They have no eyes, but are highly sensitive to light nevertheless."

Mr. Starr said that the food problem in raising earthworms is an easy one, and that table food

(Please turn to page 22)



"THE LITTLE MAN" at the White River check of the Friant-Kern canal is the automatic gadget to which Harry E. VanEvery, operations maintenance chief, is pointing, explaining its work to Edgar K. Williams, assistant canal superintendent at Delano.

Friant-Kern's Automatic Gate Tender

How the "Little Man" Tames a Big Canal

by JACKSON T. CARLE,

San Joaquin Valley District, Fresno, Calif., Region 2

EDITOR'S NOTE: As stated in this article, several automatic gate operating devices exist and are in use in Bureau of Reclamation installations, and descriptions of them will be published in future issues of the RECLAMATION ERA. However, this particular gadget was designed to improve the service to water users in a specific area where unusual problems were encountered.

"THAT LITTLE MAN is the best hand I've got! Always does what I tell him—and no questions," says Manuel Aaron.

Aaron is operation and maintenance superintendent of the Delano section of the big Friant-Kern Canal, a key unit of the Central Valley project in California.

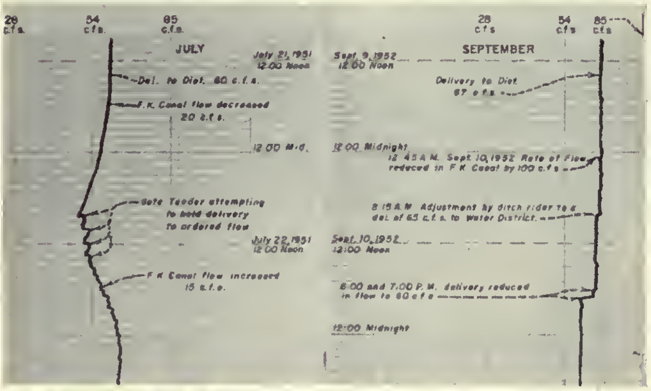
The "Little Man" is an automatic device developed by the Operations Division staff of the San Joaquin Valley District, Region 2, which controls the water level in the canal. It has been in experimental operation with remarkable success at the White River check of Friant-Kern Canal, during the entire 1952 irrigation season. Prior to 1952, it was necessary to station a man at this check gate to operate the gates as required on a 24-hour 7-day-a-week basis in order to maintain reasonably constant canal levels.

With bugs ironed out through a season of use at this location, bureau shops at Friant Dam are building improved models of the device. A "Little Man" has recently been installed at the Kaweah check on Friant-Kern Canal, another has been sent to the Delta District for experimental use on the Delta-Mendota Canal. With slight modifications, the device is believed capable of a variety of automatic operations where varying flows in main canals make it difficult to maintain steady delivery into laterals. Bureau engineers think the device will solve some of the most difficult problems of irrigation system operation.

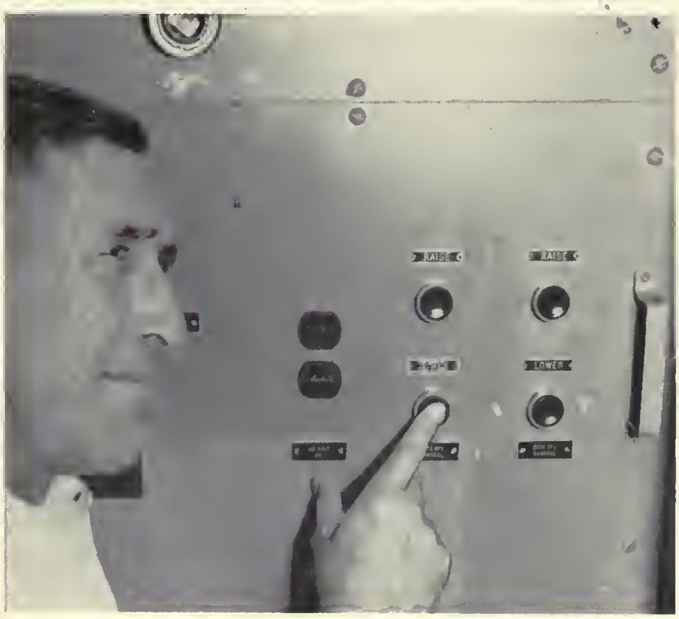
Like most inventions, the idea for the "Little Man" grew out of a need. Friant-Kern Canal, which has a designed capacity of 5,000 cubic feet per second, is operated through a series of motor-driven radial gate checks, each backing up water through the canal reach above it. Twenty irrigation districts and water user groups take service from the canal through numerous turnouts along the leveled water stretches, which form a series of steps from Friant Dam to Kern River, 153 miles to the south. Water orders from the districts determine the quantity released into the canal at Friant. The release varies from day to day, for it depends not only on the total orders, but also on the length of time, up to 3 days, for the water to reach a particular turnout.

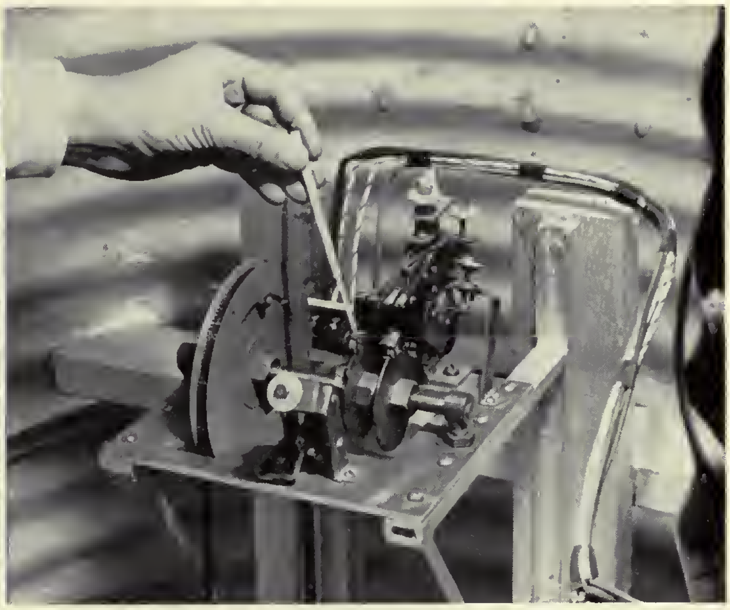
With turnout gates or valves adjusted to provide the flow of water ordered by each irrigation district, the water level in each reach of the canal must be maintained at a nearly constant level, or flow through the turnout will vary correspondingly and deliveries will not reflect district orders. More important, it often upsets the entire irrigation setup on the water users' lateral or pipeline as individual deliveries must exactly balance total deliveries from the canal. This means that the radial gates at each check must be manipulated so as to maintain a steady water level above them, despite varying quantities of water transported through the canal.

The problem that the Operations Division had



BETTER THAN "PUSH BUTTON" CONTROL.—At far left, an actual record of water deliveries through the White River turnout of Friant-Kern canal to the Delano-Earlimart Irrigation District, showing the variation under "push button" control like that at lower left, demonstrated by Harry E. VanEvery. At immediate left, the record of a comparable operation with the automatic water level regulator. Roy W. Heath has removed the front panel of the radial gate control board to show the four wires connected with the "little man." At right center, a closeup of the synchronous motor unit, installed above the control board at White River. At far right, Harry E. VanEvery (left), Roy W. Health (center), and Edgar K. Williams test the automatic device at White River. The regulator is housed in the corrugated iron well casing at center, the motor unit in the small box on top of the control panel.

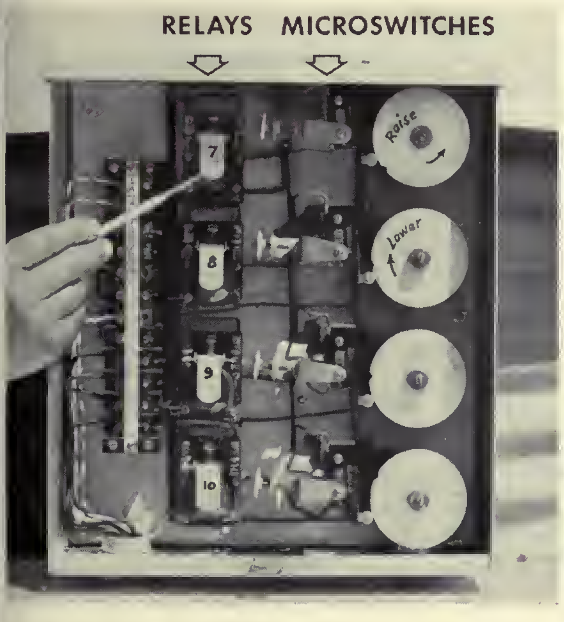




SIMILAR TO A THERMOSTAT, the automatic gate tender raises and lowers the gates according to the amount indicated on the turnout settings. Here Glenn C. Beach puts together the float pulley-cam unit at the Bureau shop. This unit is operated by a float.

Photo above is a close-up of the unit installed at the top of the well extending into the canal at the White River check, showing wires extending to the relay-synchronous motor unit. The indicator points to a "brake" on the pulley-cam shaft movement.

to solve was how to maintain constant water levels at many of the checks without men available to make frequent adjustments. Gate tenders at checks north and south of White River, for instance, cannot determine the water level above White River without making a special trip. Immediately above the White River check is a large turnout for the Delano-Earlimart Irrigation District. Early operating experience showed a lot of difficulty in keeping the Delano-Earlimart turnout flowing uniformly at the rate ordered by the District. During the 1950 and 1951 irrigating seasons, a gate tender was stationed at White River, housed in a trailer at the canal bank. Even with constant adjustment of check and turnout gates, the season's operating record, shown on charts recording flow through the turnout, was unsatisfactory. (Continued on next page)



Faced with a limited budget for personnel, as well as the necessity for improving service to the water users, Paul T. Ragle, operations chief for the San Joaquin Valley District, told maintenance chief Harry E. VanEvery, "We've got to do better. What we need is a gadget—something automatic and more sensitive to changes in water level than any gate tender we can station there."

VanEvery searched trade and technical literature for regulating contrivances to answer the White River problem. While he found several automatic operating devices, and got ideas of possible approaches to the problem, he found none that would satisfactorily fill the bill.

"It's up to us," he told Roy W. Heath, technician in charge of the district's mobile radio system, and Glenn C. Beach, electrical maintenance man and general fixer-upper, as he outlined the problem and possible solutions.

With VanEvery contributing ideas, Heath, electrical circuits, and Beach doing the physical tinkering during spare time from regular duties, the "Little Man" emerged ready to try out on the White River check last spring. It worked. The automatic control effectively regulated the canal level through the summer and fall irrigating season. Ditch riders now go to the check and turnout only to change turnout settings to conform with new district orders or to service the recorder which makes a chart of deliveries.

The installed check mechanism at White River consists of two radial gates, each raised or lowered by electrical motors geared to the cable hoist. The gates may be operated by pressing a "raise" or "lower" button on a control board. The automatic device ties into this existing installation without alteration of the mechanism or motor control circuits. The gates still may be adjusted by pressing the buttons, although no need for such adjustment has arisen since the "Little Man" was installed.

Here's how the "Little Man" does the job:

It keeps a finger on the pulse of the canal by a float installed in a corrugated metal stilling well in the middle of the canal immediately above the check gates. Water is admitted to the well by a ½-inch hole through the casing. The small hole insures that the water level inside the well will not fluctuate from ripples or waves on the canal surface, but will respond to actual changes in water level. The float, a standard recorder type, is attached to a tape running over a pulley at the top of the well. The pulley and the shaft upon which it is mounted rotate as the float is raised or lowered. This same shaft carries two eccentric brass wheels, or cams, one to operate as the float goes down, and the other as it goes up.

As these cams rotate in either direction, they operate microswitches used to energize electrical circuits. These circuits could be used directly to turn the motors which raise or lower the check gates, but this causes excessive gate operation and would not take care of changes below the check.

To solve these two problems, Heath designed a second unit, including relays, small clock motors and a second set of microswitches. When the float unit turns the cams, the clock motors go into action. They turn disks with variable notches on the rim. As the notches pass the second set of microswitches, the switches are closed for brief intervals, activating the electric motors which operate the radial check gates. In these brief intervals of operation, the check gates are hoisted or lowered by small amounts. In between the intervals of operation the water level above the gates has time to reflect the changed gate setting. This likewise minimizes the "hunting" action of the gates and reduces the up and down movements required to arrive at the correct gate setting.

At White River, for best results, the notches are set on the disks so that the check gate motors are energized approximately one second out of each minute. In routine operation, the canal level is maintained by operating only one of the two radial gates. A large surge, or continuing raising or lowering of the canal level, brings the second check gate into operation. One of the advantages of the arrangement is that no electrical circuits are in operation unless the device is adjusting the water level.

Efficiency of the "Little Man" in maintaining constant rate of delivery to the Delano-Earlimart Irrigation District, despite varying flow through Friant-Kern Canal, is shown in the accompanying illustration, comparing typical days of operation with a gate tender stationed at the White River check in 1951 and under automatic regulation in 1952.

The automatic control mechanism can hold fluctuations in canal level to within one-fourth inch above or below the level it is set to maintain. It quickly finds the correct gate setting to maintain the proper level, making required final adjustments within 15 minutes under maximum operating changes of flow through the canal. Mean-

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PEN-AIR SWAP SHOP.—Here we find irrigation operators from l over the Northwest exchanging ideas on how to improve irrigation farming methods and cut costs during the 1952 field tour of the Minidoka project. *Photo by Ted Nelson, Region 1.*

TRADING IDEAS FOR PROFIT

by DICK LARSEN
Region 1 Headquarters, Boise, Idaho

IRRIGATION OPERATORS FROM ALL OVER the Pacific orthwest were in the crowd along the lateral ank, as the new type ditcher demonstrated how could clean out the 4-foot lateral in one neat ass. Some in the 40-man group nodded their eads. "A nice little rig . . . Come in handy in leaning out ditches back home."

This was the second annual irrigation operators' eld trip sponsored by the Bureau of Reclamation n Region 1. The aim of the affair was to learn rigation ideas from each other, and that's just hat was going on. It was September and the en were on the lands of the Twin Falls Canal Co. n the Minidoka project in Idaho. The day beore, they had visited the Big Wood Canal Co. nd American Falls Reservoir District No. 2. Beore they were through, they would also have oured North Side Canal Co. lands. Everywhere hey had been seeing "nice little rigs" and picking p scores of new ideas that would be possible on heir own projects. The host project was beneting, too. If one of the visitors had a better, heaper way to do a job, he spoke up.

The idea for such field trips was born about 4 ears ago, when a few Bureau of Reclamation operators in the Pacific Northwest went on an idea-exchanging inspection tour of the Boise project. The following year no trip was made, but organizer Ted Nelson of the Boise regional office learned that a number of operators of private companies, having heard of the earlier trip, were interested in joining the next one. Neighboring irrigation companies, often faced with identical problems, could probably profit by swapping ideas with each other, Nelson reasoned, and so new plans were laid.

The first trip of private operators and Bureau representatives was made to the Yakima project in September 1951. They inspected the irrigation works, they learned how manpower can be saved in running pumping plants, how aromatic solvents control water weeds and how practical they are on large canals. They learned how the Yakima weir box saves time in water regulation and maintenance. They talked and swapped other ideas.

The 1952 trip attracted even more interest after the success of its predecessor. Irrigation men from the Boise and Minidoka projects of Idaho, the Owyhee, Vale, and Umatilla projects in Oregon and the Columbia Basin and Yakima projects of Washington were along as the group went onto the

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W. C. AUSTIN—Under New Management

by MATTYE WILSON WILLIAMS, Secretary, Altus Chamber of Commerce, Altus, Okla.

EDITOR'S NOTE: The following unsolicited article came as a gratifying although complete surprise to the RECLAMATION ERA. With all due modesty, we have deleted some of the more laudatory remarks by the Secretary of the Chamber of Commerce in favor of publishing more of the factual and historical data which should be of interest to our water user readers. We are proud of the record made by the Bureau of Reclamation employees and are glad they did so well in living up to the motto: "Service is our Business."

FOLLOWING IN THE FOOTSTEPS of other irrigation projects of the Nation, which have been constructed and operated for a time by the Bureau of Reclamation, the Lugert-Altus Irrigation District, representing the water users, assumed responsibility for management of this pioneer irrigation development in Oklahoma on October 1, 1952.

After 6 years of successful operation, during which time new crops have been introduced, production yields in many instances tripled, and numerous new industrial plants have been opened in the city of Altus, the Bureau staff is departing to devote attention to other new project developments throughout the land.

It is with no small amount of regret that Altus and southwestern Oklahoma citizen witness the departure of Bureau of Reclamation employees. Not that there is a doubt of the success of operation under the three-man board of directors, two of whom have been on the board since organization of the district, and the third an equally experienced farmer and business man of the area. Regret comes from losing the Bureau officials and personnel.

Establishing homes in Altus, assuming responsibilities in the civic, social, religious, and educational growth and development of the city and entire district, Bureau employees became such leaders that their departure, which will be felt by all, creates a distinct vacancy.

When one needed to know the official amount of rainfall, when need arose for a square dance caller, when dignitaries arrived for visits to the city, when farm tours or other agricultural projects were undertaken, when church groups sponsored projects, in fact when anything for the advancement of the area was undertaken, Bureau employees were always willing to help out. So numerous have been the acts of community service performed by the Bureau employees that it would be impossible to list them.

Here, however, to carry out the assignment of initiating and putting into successful operation the pioneer irrigation project in Oklahoma, and one which is serving admirably as an example for

THE NEW MANAGER.—Howell V. Zinn, who on October 1, 1952, took over the job as new manager of the Lugert-Altus Irrigation District, which now handles the affairs of the W. C. Austin project in southwestern Oklahoma, from the former Bureau headquarters at the north edge of Altus.—*Photo by Fred S. Finch, Region 5.*

THE NEW DIRECTORS.—From left to right, R. W. (Bob) Minor, Carthal F. Mock (Chairman), and Clark T. McWhorter. Minor and Mock have been members of the board since the district was organized in 1940. McWhorter was named in August 1952 to succeed Joe B. Zinn. *Photo, courtesy Altus Chamber of Commerce.*

OUTSTANDING SERVICE TO THE COMMUNITY.—James A. Callan, Bureau project engineer, and Chamber of Commerce president R. W. Moore, holding the commemorative plaque. Altus Dam in the background.—*Photo by P. W. George. Inset photo submitted through the courtesy of the Altus Chamber of Commerce.*

uture anticipated projects, the officials and staff ave accomplished their task well.

The project was initiated about 10 years ago nder direction of R. S. Lieurance, now deceased. t was during his tenure that the District signed he repayment contract. Later it was managed y Howard Robbins (now director of Region 5 ith headquarters in Amarillo, Tex.), followed by Vayne Byrne, now in Australia, and more recently y James A. Callan. Callan, who joined the Bureau in August 1927, came to Altus in Septemer 1942 from the Buford-Trenton project of the Missouri River at Williston, N. Dak.

Peak employment by the Bureau on the local roject occurred in 1941 and 1942 when there was total of 365. Employment gradually decreased ver the years. Now a lone employee, J. S. Savge, reservoir superintendent, resides at the site of he dam at Lake Altus.

In June 1947 water started flowing to a portion f the 48,000-acre project, now served by the disrict works. Income of the land since that time has ncreased to where it now shows a ratio of about to 1 in comparison with nonirrigated acreage.

Three bales of cotton per acre, 15 bushels of lfalfa seed per acre from one 20-acre field, and rish potatoes which grossed approximately $800 per acre are among the outstanding examples of vhat spreading a water supply during the irrigaion season to fill in the gaps left by deficient ainfall actually does on the W. C. Austin project.

Being watched particularly close at this time is a 60-acre lettuce field, the first attempt at growing this vegetable in this area. Prospects are for a $1,000 gross income per acre from this new venture. Lettuce, potatoes, black-eyed peas, soybeans, castor beans, onions, and permanent pastures are among the most promising crops which have been tried since irrigation water has been available to supplement local precipitation.

Two potato-processing plants and a castor-bean plant are industries which are a direct result of the irrigation project.

In preparing for its new duties, the district board appointed Howell V. Zinn of Blair, Okla., as district manager, a position created by the district's increased activities in the project operation.

Zinn, who worked with the Bureau from January 1948 (first in Altus and later with the Missouri River Basin in Nebraska) until 1951, is a native of southwestern Oklahoma. He served from July 1, 1937, until May 20, 1944, as a member of the Jackson County Board of Commissioners.

He will work directly under the supervision of the irrigation board, which includes Carthal F. Mock and R. W. (Bob) Minor, who have been members of the board since its organization, and Clark T. McWhorter, appointed recently to succeed Joe B. Zinn. Mock is now chairman for the board.

In turning over the management and operation of the project to the district, Callan urged the farmers to be ever mindful of the importance of water conservation. ###

BLACK CANYON'S NEW APRON

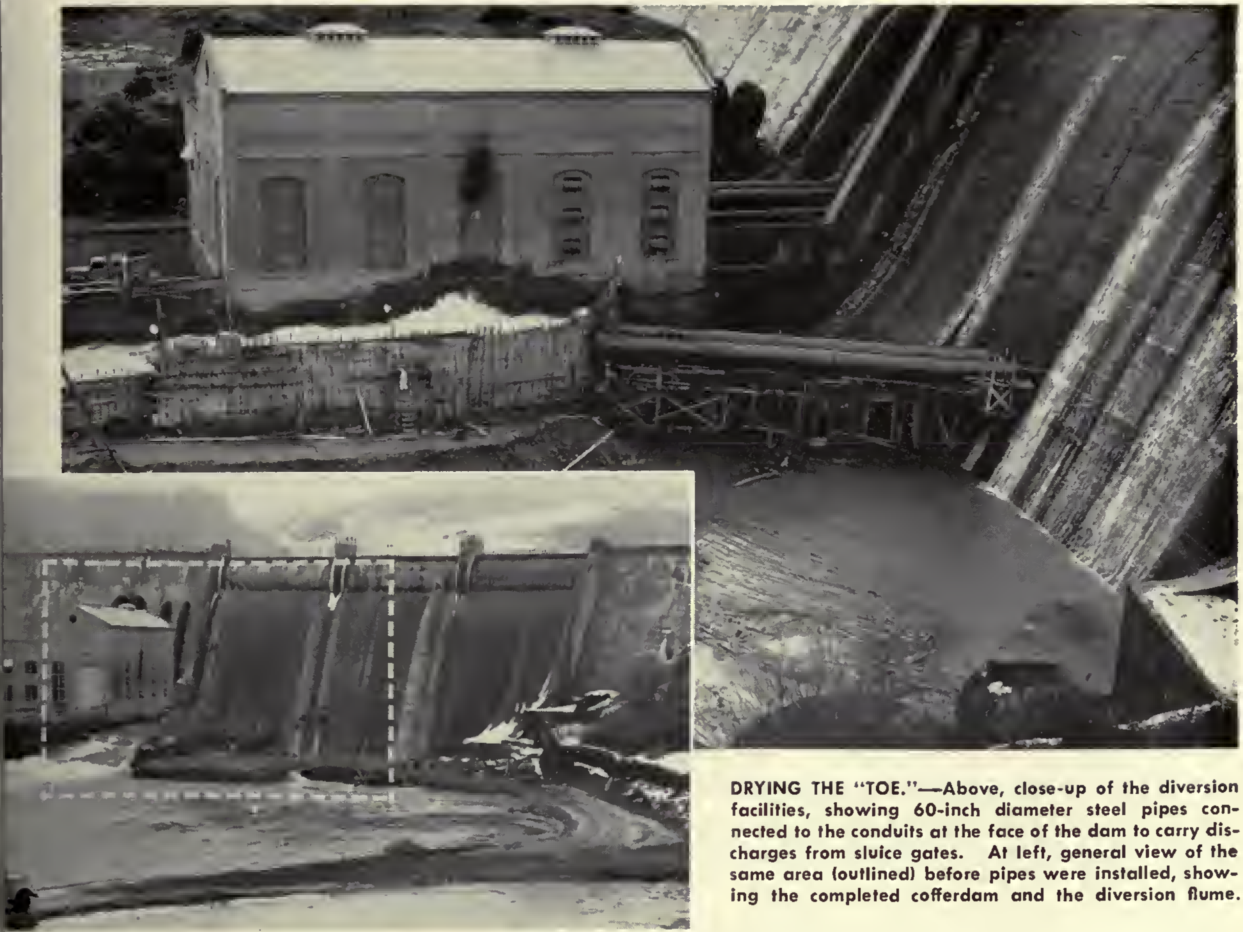
"FACE LIFTING" OPERATION.—*Arrows point to apron area. When completed, it contained 5,900 cubic yards of concrete. All photos for this article by Phil Merritt, Region 1 photographer.*

LAST SPRING A CONSTRUCTION CREW won a race between time and the Payette River.

After 28 years of serving the 75,000-acre Boise project area, Black Canyon Dam was in urgent need of rehabilitation. The toe of its steep overflow spillway section was wearing away under the onslaught of discharges as high as 25,000 cubic feet per second. No one knew how serious the situation was until October 1951 when Bureau diver D. S. (Spud) O'Donnell made an underwater examination of the toe of the dam, feeling his way in 80 feet of murky water. Up to that time soundings had been taken to learn the extent of the erosion as excessive uplift pressures were known to exist in the dam foundation. In 1937–38 an unsuccessful attempt was made to unwater the toe. O'Donnell's inspection confirmed everyone's suspicions—erosion and undercutting had taken place at the toe.

Consulting Engineer John L. Savage was called into consultation. He and Chief Engineer L. N. McClellan forwarded urgent recommendations to Reclamation Commissioner Michael W. Straus that repairs be made before the heavy spring runoff. Emergency funds amounting to $500,000 were made available. The chief engineer expedited preparation of plans and specifications for the job. On December 21 bids were opened at Denver and contract awarded to Morrison Knudsen Co., Inc., of Boise, which had made the best offer. Before the month ended, M–K had equipment rolling onto the job and within days the initial job of constructing facilities for carrying stream flows past the construction area was under way.

Crews, working rapidly in raw snowy weather, began constructing facilities to divert the water around the toe of the dam where the concrete apron was to be added. A flume was formed by constructing a concrete wall along the right side of the river channel parallel to the 8,000-kilowatt power plant and retaining wall downstream, ex-



DRYING THE "TOE."—Above, close-up of the diversion facilities, showing 60-inch diameter steel pipes connected to the conduits at the face of the dam to carry discharges from sluice gates. At left, general view of the same area (outlined) before pipes were installed, showing the completed cofferdam and the diversion flume.

nding from the turbine outlets downstream for pout 175 feet. The flume was to carry the comned discharge of the turbine outlets and two foot sluice-ways—about 3,000 cubic feet per secid. Discharges from the sluice gates were conyed into the flume by 60-inch diameter steel pes leading to a concrete cross-wall at the upream end of the flume.

By early February the diversion works were iished and it was possible to unwater the toe of e dam. Two 12-inch electric deep-well turbine imps and a number of gas engine suction pumps ent to work running water from the hole. By id-February the hole beneath Black Canyon am was unwatered. Soon thereafter, heavy ucking with a dragline and clamshell bucket d been finished and the contractor was ready begin placing concrete. At the unwatered toe the dam they had found a hole gouged 8 feet

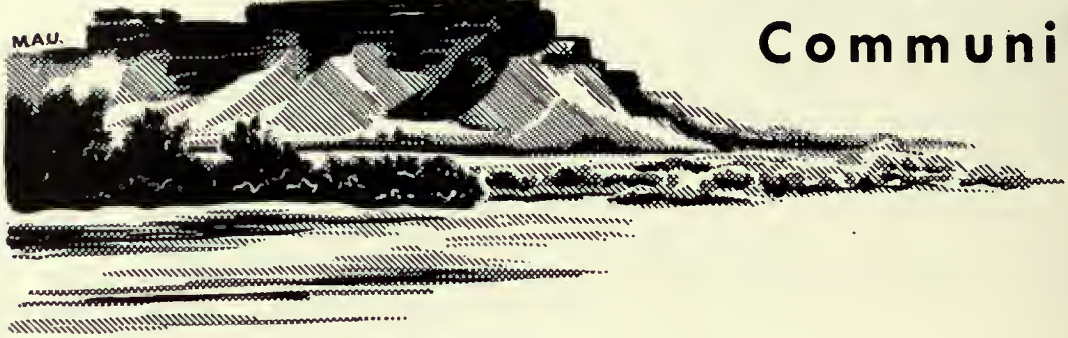
ACK CANYON'S "STUBBED TOE."—This shows how the toe of dam was eroded and undercut. After the cavity was cleaned t, a formation of hard, well-cemented conglomerate and sandne was exposed, providing a firm foundation for repair.

below the original foundation, extending under the dam several feet.

At this point, a board of engineers appointed by the chief engineer took a close look at the foundation preparation. There was some loose material that had to be removed, but the conglomerate and sandstone in the bottom was considered a

(Please turn to page 21)

SCOTTSBLUFF, Prizeworthy Pioneer Community



by TED PICKETT, Scottsbluff, Nebraska

The 16-year-old author, a junior at Scottsbluff High School, won first prize for the following article in Western Air Lines' "Sell your Community" essay contest, in which 22 high school and junior college students participated. Due to its references to irrigation and the North Platte project it is published here as a matter of interest to our readers, and an example of the younger generation's view of a reclamation area.

If you're going west, why not travel the pioneer route? On your way stop and visit Scottsbluff, Nebr.

Scottsbluff got its start back in 1899–1900 when the Burlington Railroad extended its line further west. At first Scottsbluff wasn't much; but once the spark was kindled, things happened fast. After irrigation was introduced and the vast agricultural possibilities were tapped, Scottsbluff grew rapidly and its culture and government right with it.

The city is as historically significant as any in the State. The old Oregon and Mormon Trails and the Pony Express passed through this valley on their way westward. The broad, fertile valley of the North Platte River was an early fur trapper's paradise. A fur trapper, Hiram Scott, gave Scottsbluff its name by dying on a lonely bluff near here, deserted by his companions.

Chimney Rock, Courthouse Rock, Jail Rock, and Mitchell Pass are landmarks that guided the pioneers. They are still visible and are visited every year by thousands of tourists.

The construction of the Big Laramie and Tri-State Canals of 1904 turned what used to be part of the "Great American Desert," into America's Valley of the Nile. Soon after completion of these canals, the Great Western Sugar Co. built a beet sugar factory at Scottsbluff. This made the raising of sugar beets the most profitable agricultural industry. Although beets remain the most important crop, potato and bean production is increasing steadily. The sugar beet industry with its beet tops and pulp gave rise to livestock feeding, until this valley has become one of the principal beef and lamb producing areas in the United States. This high production could not be maintained if it were not for the abundance of alfalfa grown here. In turn Scottsbluff has become the leading meat packing and marketing center of the North Platte Valley. The Swift Packing Co. maintains the largest plant in this area. It ships carloads of dressed meat to leading cities, while smaller independent packing houses serve locally.

Today Scottsbluff has a very adequate educational system with excellent facilities. For her three thousand students, Scottsbluff has four modern grade schools, a new junior high, and a recently remodeled high school. By the new gym addition our high school has one of the best basketball setups for a school of its size. A new stadium was added to our football field. There is a well-rounded athletic program in each school and there are activities designed to interest every student beginning in the grades, through high school and junior college.

Scottsbluff is lucky to have such excellent utility companies. The North Central Gas Co. of Wyoming has a local office which serves this vicinity with efficiency. Consumers Public Power District has a generating plant here which furnishe ctricity for miles around. A locally owned lephone company also employs many people to d its bit to Scottsbluff's industry.

Lately Scottsbluff has turned its interest in the rection of the oil business. Oil executives and a w movie stars have visited Scottsbluff to instigate oil possibilities. New producing wells e located south of Scottsbluff and a new pipe-ne is being installed to carry the oil to the re-neries in larger cities. The Panhandle Co-Op s a refinery in Scottsbluff to refine some of the l here. In connection with the refinery, Co-Op s two gasoline stations to sell its finished prod-ts. Oil companies have invested great sums of oney to uncover oil possibilities in western Ne-aska. Hopes are that new oil fields will be dis-vered here. This would help Scottsbluff eco-mically. Already the effects of the new in-istry are being felt in Scottsbluff.

The city can't be mentioned without taking tice of the many potato cellars which dot the itskirts. The potato industry has become quite rofitable in the last few years. Companies from rge markets have numerous warehouses estab-shed and buy a high percentage of the potatoes own.

Recently new alfamix mills have been popping throughout this area to lessen the waste in feed-g. Many products which ordinarily would be asted are combined into a feed for livestock.

To bring Scottsbluff nearer the larger markets, e has good facilities to ship finished goods and roducts. Western Air Lines has convenient con-ctions to all of the more important cities. The urlington Railroad has a branch line which runs through the area and serves to connect it to other markets.

"ELECTRICITY FOR MILES AROUND."—The Lingle power plant, one of the first built by the Bureau of Reclamation, astride the Fort Laramie Canal which supplies irrigation water for the south side of the Platte valley. ***Photo by Norton T. Novitt, Region 7.***

If you are interested in living in a climate of long sunshiny days, deliciously cool summer nights, mild winters tempered by the gentle chinook winds, you can't afford to overlook Scottsbluff. Many people come here with respiratory troubles and enjoy the clean, dry, healthful air.

The surrounding lakes, marshes, and rivers are abundant with wildlife. Sportsmen come here during the open seasons to hunt deer, ducks, pheasant, and geese. Many families come here for vacations because the fishing is good.

If you're looking for new frontiers, there are opportunities for enterprising people right here in Scottsbluff. ###

Black Canyon's New Apron

(Continued from page 19)

mpetent foundation for the 5,900 cubic yard pron. On February 23, concrete began moving ito the hole while the flume arrangement was orcing the reluctant Payette River around the ork area. Oldtimers, familiar with the runoff attern of the Payette River, doubted the job ould be done before the river rose. Day and ight a concrete batching plant downstream from e dam was loading trucks which roared up to e big hole downstream from the dam, where a rane was swinging a 1 cubic-yard concrete bucket ito the apron forms.

By March 25 the rising river had filled the Black Canyon Reservoir to near the dam's spilling level. On that day the last bucket of concrete had been placed and Black Canyon Dam was wearing its new apron. Four days later the water began spilling, but the contractor had removed virtually all the diversion facilities and equipment. Not enough time was available to completely remove the concrete flume wall. It had to sit alongside the river all summer until conditions permitted its removal.

The complete Black Canyon rehabilitation includes a concrete face for the rest of the dam and more concrete to strengthen the abutment sections. The rest of the work, however, can be done without unwatering. ###

Orland's Fertilizer Factory

(Continued from page 10)

scraps and lawn clippings are sufficient to feed a great number of worms.

"Any plant or animal material, provided it first has been decayed, will feed a worm," Mr. Starr declared. "A compost pile is my answer and it is a handy means of garbage disposal as well.

"I grind almond hulls for sugar and alcohol content, clover-seed cleanings for proteins, and for fats, black walnuts ground up with husks, shells and meats. In fact, you could say that my worms have cast-iron stomachs; they'll eat anything including old burlap sacks."

Earthworms not only eat practically anything, and are prolific in reproduction, but they have earned a reputation as the greatest living soil chemists and soil builders, the worm fancier said.

"A worm excretes an amount equal to his own weight each 24 hours," Mr. Starr said, "and this substance is the most perfect fertilizer known. It contains tremendous percentages of nitrogen, phosphate and potash. Sort of an automatic fertilizer factory, you might say.

"But best of all, he makes money for us, enriches the soil, makes the fisherman happy, provides the means for research, and he works for practically nothing. He's on the job 24 hours a day, 365 days a year, and never wants a raise in pay. In my opinion the lowly earthworm is not as lowly as most people think." # # #

Friant-Kern's Automatic Gate Tender

(Continued from page 14)

while, this large turn-out delivery does not vary by more than 2 cubic feet per second during the adjustment interval and thereafter returns precisely to the ordered flow.

Even comparatively small variations in turn-out flow make a life-sized problem for irrigation districts and farmers. Sam C. Fortier, engineer for the Delano-Earlimart District, says "Under manual operation last year we frequently were wasting water through the district, or the farmers at the lower end of the lateral couldn't get it. When you are dealing with a large main canal, such as Friant-Kern, a variation of 2 or 3 second-feet doesn't sound like much, but the average farm delivery is only about 2 second-feet and a reduction of this amount in turn-out delivery may mean no water to one or more of the farmers who are depending on it.

"Operation of the automatic canal level mechanism has been very satisfactory. It is particularly needed when we are taking minimum flows."

Ragle is enthusiastic about possible applications of the device developed by the operating staff under his direction. Looking into the future, he sees its possibilities for smoothing out the highly variable flow of CVP's 120-mile Delta-Mendota Canal, where operation of the Tracy pumps during off-peak power consumption periods is producing large fluctuations in flow and hence a sizeable canal operating problem.

But Manuel Aaron is happy about the results already achieved.

"That's one problem we don't have any more," he points out. ###

Trading Ideas for Profit

(Continued from page 15)

big Minidoka project. They stopped at a bench flume where Rosin-Amine D-acetate was being experimented upon as an algae controller. Farm delivery measuring devices were inspected and they chatted about the head loss requirements for the successful operation of a Cipolletti weir and an adjustable submerged orifice. There was discussion of the methods of delivering water and curbs on the excessive use of water, how to promote the most efficient distribution during the peak demand season, and dozens of other tricks in field operation. They talked of the general organization of various sizes of companies and districts, manpower requirements, equipment maintenance, performance of equipment and new developments to keep an eye on.

The handful of Bureau of Reclamation men in the group were also getting valuable tips and learning of problems facing other organizations. The operators, in turn, were learning that the Bureau was facing a maze of problems on not just their own, but on several other projects. Fresh understanding grew.

The 1952 field trip lasted 2½ days, and another half-day was devoted to a discussion period. The perpetual question was, "How can I cut costs?" There were plenty of possible answers. The trip promised to make itself felt throughout the year improved field operations and in the more fa-rable balance sheets of water users' organiza-ns, as well as serving as an inspiration for other gions in the West to assemble in like manner for e benefits. # # #

tle Porcupine Plant Turbine Contract Let

Another contract for the "ten new starts" was arded late in November to the Newport News ipbuilding and Dry Dock Co. of Newport News, ., to furnish three 8,400-horsepower hydraulic rbines for the Little Porcupine Power Plant of e Missouri Diversion Unit, Missouri-Souris Di-sion of the Missouri River Basin project near azer, Mont.

The Porcupine Plant will provide more than 128 llion additional kilowatt-hours of electric en-gy annually for eastern Montana and northwest-n North Dakota where power requirements are atively high because of extensive use of power nonferrous metal industries.

According to the plans for the project, the Little rcupine Power Plant will be built as part of the issouri Diversion Dam 22 miles downstream om Fort Peck Dam. This diversion dam will vert water for the irrigation of more than 0,000 acres of land in the region. •

Settlement Opportunities

A tentative schedule of settlement opportunities Reclamation projects during the coming year s just been announced. Veterans will have pref-ence for homesteading or purchase in all cases. total of 313 farms comprising 30,227 acres will available for settlement either through home-ead entry or purchase. Lands on the Columbia asin project in the State of Washington are avail-ble for purchase with an opening date for late nuary or early February. Public lands on the inidoka project in Idaho will be available for mesteading about the same time.

Public lands in the Coachella Division of the ll-American Canal project in California are heduled for opening about May 1953, while quired lands in the Wellton-Mohawk Division f the Gila project in Arizona will be available r purchase around October.

On the Angostura project in South Dakota, nds will be sold to settlers by the Soil Conservation Service around June 1953. This action is being taken under the Wheeler-Case Act.

For further information, write to your nearest Regional Director. See directory on inside back cover of this issue. •

Pactola Dam Contract Awarded

The Adler Construction Co. of Loveland, Colo., was awarded the contract for construction of the Pactola Dam and Reservoir in western South Dakota on October 14. The work, which provides for a 225-foot high, 1,250-foot-long earth-fill dam with 2,100 feet of dikes, will be completed as speedily as possible to provide storage space for 99,000 acre-feet of Rapid Creek water, a major part of which will be used to furnish a full supply for the Rapid City Air Base and the municipality of Rapid City.

The Rapid City Air Base has not had an adequate water supply since its establishment in 1942 and at one time during the war it was necessary to haul 100,000 gallons of water per day in tank trucks from Rapid City to meet the demands. This project, one of the "ten new starts," and the key water control structure in the Rapid Valley Unit, Cheyenne Division, Missouri Basin project, will also provide flood protection for Rapid City, and additional recreational opportunities along with fish and wildlife protection, and ultimately furnish a full supply of irrigation water for 2,200 acres of new land and a supplemental supply for 8,900 acres. •

FIRE AND ICE

Shortly after the December issue of the Reclamation Era went to press we received a communication that had very definite bearing on the article entitled Riverton's "Slush Plow" on page 280. We were advised that the plows had been destroyed by fire at the Wind River Diversion Dam. However, Project Manager Mendenhall informs us that orders have been placed for new motors and propellers so the slush plows may be put into use during the winter season. •

NEXT MONTH—THE FIRST YEARS ARE THE HARDEST—stories of the problems facing the people who are operating the Columbia Basin and Central Valley projects.

NOTES FOR CONTRACTORS

Contracts Awarded During November 1952

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Con[tract] amou[nt]
DS-3770	Central Valley, Calif.	Nov. 13	Two 230,000-volt circuit breakers and 1 bushing potential device for Folsom-Elverta terminal switching facilities.	Brown Boveri Corp., New York, N. Y.	$99,
DC-3781	Missouri River Basin, S. Dak.	Nov. 21	Construction of 55 miles of Oahe-Midland 115-kv. transmission line.	R. N. Campsey Construction Co. and C. F. Lytle Co., Denver, Colo.	508,
DS-3793	Missouri River Basin, Mont.	Nov. 21	Three 8,400-hp. hydraulic turbines for Little Porcupine power plant.	Newport News Shipbuilding & Dry Dock Co., Newport News, Va.	835,
DS-3799	Central Valley, Calif.	Nov. 13	Four vertical-shaft pumping units for Contra Costa pumping plants Nos. 1, 2, 3, and 4.	Fairbanks Morse & Co., Kansas City, Mo.	71
DC-3801	Cachuma, Calif.	Nov. 5	Construction of earthwork, pipelines, and structures for 12.8 miles of Glen Anne laterals, Goleta distribution system.	R. A. Wattson Co., North Hollywood, Calif.	522
DC-3808	Gila, Ariz.	Nov. 7	Construction of earthwork, concrete canal and lateral lining, and structures for Wellton canal, lateral M-14.8, and Unit 1, Wellton distribution system.	Morrison-Knudsen Co., Inc., Los Angeles, Calif.	1,318,
DS-3811	Columbia Basin, Wash.	Nov. 26	Five lots of radio communication equipment, 10 mobile radio transmitter-receiver assemblies, and 600 linear feet of radio frequency coaxial cable for Othello, Ephrata, Warden, Mesa, and Eltopia substations.	Motorola, Inc., Chicago, Ill.	11,
DS-3813	do	Nov. 20	Structural steel for railroad bridges on East Low canal.	Bethlehem Pacific Coast Steel Corp., Seattle, Wash.	47
DC-3817	Missouri River Basin, Kans.	Nov. 5	Construction of Webster dam foundation.	H. N. Rodgers & Sons Co., Memphis, Tenn.	993,
DC-3818	Central Valley, Calif.	Nov. 28	Furnishing and installing 1 electric elevator in service bay of Folsom power plant.	Independent Elevator Co., Inc., San Francisco, Calif.	39,
DC-3820	Riverton, Wyo.	do	Furnishing and applying catalytically blown asphalt membrane lining to 6.99 miles of Pilot and Wyoming canal laterals.	Studer Construction Co., Billings, Mont.	29
DC-3821	do	do	Furnishing and applying asphaltic membrane lining and cover material to 0.85 mile of Wyoming canal and 6.15 miles of lateral.	L. H. Weber, Rawlins, Wyo.	85
117C-173	Columbia Basin, Wash.	Nov. 20	Residence, farm buildings and utilities at Othello development farm.	Westover and Hope, Quincy, Wash.	29,
117C-174	do	Nov. 5	Earth blanketing, Potholes East Canal.	Riverbend Contractors, Inc., Portland, Oreg.	32,
200C-218	Central Valley, Calif.	Nov. 4	Constructing headquarters camp at Sly Park.	Tricon Construction Corp., San Rafael, Calif.	95,
300C-48	Colorado River Front Work and Levee System, Ariz.-Calif.-Nev.	Nov. 19	Furnishing and erecting shop building at Needles, Calif.	Pascoe Steel & Constructing Co., Pomono, Calif.	20,
300C-50	Gila, Ariz.	Nov. 14	Repair of concrete canal lining, Wellton-Mohawk, Wellton and Mohawk Canals.	Young & Smith Construction Co., Salt Lake City, Utah.	254, 2
601C-20	Shoshone, Wyo.	Nov. 20	15 miles of drains, Heart Mountain Division.	D. M. Manning, Contractor, Hysham, Mont.	115,

Construction and Materials for Which Bids Will Be Requested by March 1953

Project	Description of work or material
Central Valley, Calif.	Construction of 760 foot long by 175 foot high earth- and rock-fill Sly Park Dam, part of the American River Basin development, also involves a 600 foot long by 97 foot high earth-fill dike, an outlet works, and uncontrolled spillway. Total volume of dam and dike will be about 1,100,000 cubic yards. The dam will be in Eldorado County near Camino, Calif.
Do.	Construction of 8 power turnouts of 2- to 6-c. f. s. capacities, 3 gravity turnouts, and 20 laterals consisting of 10 miles of 12- to 30-inch diameter concrete pipe for Plainview Water District distribution system on the Delta-Mendota canal about 2.5 miles southwest of Tracy, Calif.
Do.	14 vertical-shaft, motor-driven pumping units from 2- to 7-c. f. s. capacities and heads from 10 to 31 feet, and 8 vertical-shaft, motor-driven moss screen pumping units from 180 to 300 g. p. m. at 230-foot head for Delano-Earlimart irrigation district.
Do.	2 vertical-shaft, turbine-type, 350-g. p. m. unwatering pumping units; 3 vertical-shaft, turbine-type, 500-g. p. m. drainage pumping units; 2 horizontal-shaft, centrifugal-type, service water pumping units; 3 gear-type oil pumping units; and 2 sludge pumping units for Folsom power plant.
Colorado-Big Thompson, Colo.	Construction of 2.5 miles of 28-foot wide, gravel-surfaced Pole Hill access road, including corrugated metal pipe culverts and a 118-foot long timber bridge, 5 miles west of Loveland, Colo.
Do.	Installation of circuit breaker and 69-kv. metering equipment at Holyoke substation.
Columbia Basin, Wash.	Construction of a 1-story, 7,240-square-foot masonry structure with partial basement for guard and fire headquarters at Coulee Dam, Wash.
Do.	Construction of 6 pumping plants for Lateral Area E-5 on East Low canal near Warden, Wash., with following capacities: 135 c. f. s. Warden plant consists of three 45 c. f. s. units; Warden relift plant, two 20.5 c. f. s. and two 8 c. f. s. units; North Warden plant, three 24 c. f. s. units; EL 63.1E plant, two 4.5 c. f. s. units; EL 61.7 plant, two 7 c. f. s. units; EL 61 plant, two 8 c. f. s. units.
Davis Dam, Ariz.	Erecting steel structures and installing electrical equ[ip]ment at Prescott substation.
Davis Dam, Ariz.-Nev.	Interior painting of all metalwork, structures, an[d] equipment in Davis dam and power plant.
Eden, Wyo.	The 4-mile second section of Eden canal, 44 miles n[orth] west of Rock Springs, Wyo., requires 1 mile eac[h] 300 and 150 c. f. s. capacity and 2 miles of 200 c [f. s.] capacity partially earth-lined canal, and additi[onal] 4 miles of 40 to 6 c. f. s. capacity Eden laterals E[-] E-11, and E-12. About 250,000 cubic yards of [exca]vation are required.
Gila, Ariz.	6 vertical-shaft pumping units for Dome pumping [plant] of the following capacities: Three 20 c. f. s. at 11[-foot] head, and three 26.7 c. f. s. at 20.5-foot head.
Kendrick, Wyo.	Repairing and widening banks and placing as[phalt] membrane lining on 0.42 mile of Casper canal [in] Natrona County, Wyo., about 26 miles southwe[st of] Casper.
Missouri River Basin, Iowa.	Construction of 53,000-kv-.a. capacity Sioux City [sub]station near Sioux City, Iowa, involves furnis[hing] and erecting steel structures and a 24- by 44-foot [pre]fabricated steel control building and installing gov[ern]ment-furnished electrical equipment. Equip[ment] includes one 53,333/66,667-kv.-a. autotransformer, 230- and 69-kv. circuit breakers and disconnect switches, and a 69-kv. voltage regulator.
Missouri River Basin, Mont.	Construction of Missouri diversion dam consists of [..] miles of earth dike embankment across Missouri R[iver] near Wolf Point, Mont., a gated concrete over[flow] section 80 feet long and 40 feet high, and 350 fe[et] concrete retaining wall 35 to 60 feet high. The ea[rth] dike is to be 30 feet high for 11,000 feet and 50 feet h[igh] for 1,000 feet. The 3-unit, 18,000-kw. Little Porcupine power p[lant] will have a reinforced concrete substructure 103 by [..] feet and 70 feet high and a government-furnished s[teel] superstructure measuring 57 by 188 feet and 45 [feet] high with insulated steel panel walls. The upstr[eam] portion of the power plant structure is designed to [act] as a gravity dam against the reservoir. The contr[actor] will construct spiral casings and install embed[ded]

Construction and Materials for which Bids Will Be Requested by March 1953—Continued

Project	Description of work or material
ri River Basin, .—Continued	parts of 3 turbines, each 8,400-hp. at 30-foot head; install a 60-ton government-furnished bridge crane; and grade the switchyard area. Also included are the headworks structures for the 7,500 c. f. s. Missouri canal which will have three 16- by 6-foot top seal radial gates, and headworks for South Side canal, three 60- by 48-inch and three 60- by 36-inch hand-operated slide gates and reinforced concrete outlet boxes.
	Construction of 7.5 miles of 100 to 35 c. f. s. Toston canal and wasteway, 3 miles of 60 to 20 c. f. s. Lombard canal and wasteway, and lateral and drainage systems.
	Construction of 100 c. f. s. Crow Creek pumping plant, 4 miles southwest of Toston, Mont., on the Missouri River, designed to lift water from the river an average of 176 feet through a 1,180-foot long, 52-inch inside diameter steel pipe discharge line to Toston tunnel for gravity flow to Toston and Lombard canals.
ri River Basin, -Kans.	Construction of a Kansas River District headquarters building at McCook, Nebr., involves converting a 14,000-square-foot brick building into an office building, and constructing a 1-story 2,000-square-foot addition with a basement of the same floor area, a concrete foundation, steel columns, and tile walls. Contract also includes constructing footings, foundations, and concrete floors for several other buildings to be erected under other contracts; and furnishing and erecting a 50- by 100-foot prefabricated warehouse; grade and surface the area; and install facilities.
	Construction of 11 miles of unlined Naponee canal, laterals, drains, and appurtenant reinforced concrete structures 12 miles west of Franklin, Nebr., on the south side of the Republican River, beginning at Harlan County Dam.
	Franklin canal's first section requires construction of 18 miles of unlined laterals and appurtenant reinforced concrete structures, near Franklin, Nebr. Capacity ranges from 12 to 6 c. f. s.
ri River Basin, ak.	Relocation of about 1 mile of the Edmond Road in the Jamestown reservoir area near Jamestown, N. Dak.
	Raising and gravel surfacing about ½ mile of Buchanan Road and constructing a new bridge over the James River in the Jamestown Reservoir area. Requires about 130,000 cubic yards of excavation.
ri River Basin, k.	Construction of the Cherry-Todd addition to the Winner substation; and the transportation and installa-
Missouri River Basin, S. Dak.—Continued	tion of power transformers at Winner, Gregory, and Bonesteel substations, all in southeastern South Dakota.
Do	Furnishing and installing three 795 MCM ACSR conductors and two ½-inch stranded steel overhead ground wires, including insulators and related hardware, on the 122-mile Fort Randall-Sioux City 230-kv. transmission line.
North Platte, Wyo	Repair of Lingle wasteway, Fort Laramie Canal, in Goshen County about 2 miles south of Lingle, Wyo., involves replacing 3 concrete floor slabs, repairing walls and floor around tubes; a concrete cut-off wall and underdrain.
Palisades, Idaho	Relocation of 5.5 miles of State Highway No. 29 about 62 miles southeast of Idaho Falls, Idaho, from Big Elk Fill to Indian Creek, requires about 1,200,000 cubic yards of excavation.
Riverton, Wyo	Construction of additional North Pavillion drains near Riverton, Wyo.
Shoshone, Wyo	Lining of short reaches of the Heart Mountain Division canal and laterals near Powell, Wyo.
Solano, Calif	Monticello dam is to be a 260,000-cubic-yard concrete arch dam about 295 feet high above ground and 1,000 feet long at the crest, with glory-hole type spillway and penstock-type outlet works, located on Putah Creek, 39 miles west of Sacramento, Calif. The spillway will have a 72-foot diameter uncontrolled crest and a 28-foot diameter outlet tunnel. The outlet works will consist of two 90-inch penstocks through the dam with valve controls. Concrete will require about 1,500,000 pounds of reinforcing steel. In ad dition, the contract is to include a 500-foot long concrete highway bridge and a 400-foot long timber bridge over Putah Creek, and some road construction. The concrete bridge will have concrete abutments, nine piers, and nine 55-foot spans; the timber bridge will have timber bents and concrete footings.
Yakima, Wash	Construction of 2 monolithic reinforced concrete railroad undercrossing siphons, 350 and 250 feet in length, on the Chandler power canal, 4 and 6 miles east of Prosser, Wash. Each siphon is to have two 11.5-foot inside diameter barrels and inlet and outlet transitions.
Do	Construction of 6.6 miles of 435 c. f. s. capacity Chandler irrigation canal and 0.6 mile of 435 c. f. s. capacity wasteway for the canal's first section, near Prosser.

United States Department of Interior, Oscar L. Chapman, Secretary
BUREAU OF RECLAMATION OFFICES

Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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THIS
UE:

Safety In Canal Operations
Teamwork At Chowchilla

February 1953

Volume 39, No. 2

The Reclamation ERA

35 Years Ago In The Era

Remember: Alfalfa Is a Basic Crop

Far-seeing men on the reclamation projects and elsewhere are concerned about a decrease in the alfalfa acreage on some of the projects last season—decreases in favor of food and other seemingly more urgent crops. I went to see an official of the United States Department of Agriculture to find out how serious the situation is and to get a statement for readers of the RECLAMATION RECORD.

"Tell them not to forget alfalfa. Tell them that such practicable adaptations in their farming as are necessary better to meet the Nation's emergency food needs are advisable, but to remember and not to minimize the importance of the crop that makes it possible to live and to build up successful farming systems on reclamation projects. Say to them that a dead goose does not lay golden eggs; that unless the foundation crop—alfalfa—is firmly established and maintained, other farming ventures cannot be undertaken with an assurance of permanent success."

(From an article on page 53 of the February 1918 issue of the RECLAMATION RECORD, predecessor to the RECLAMATION ERA.)

OUR FRONT COVER. SEE THE DIFFERENCE? Inset, corn grown without irrigation. In an adjoining field near Sargent, Nebr., was grown the lush crop of irrigated corn in the foreground. See article entitled, "Sargent Looks Ahead" on page 30. Photos by F. B. Slote, Region 7.

OUR BACK COVER is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners Kittredge and Coolidge.

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R. F. Sadler, Editor

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In this issue . . .

RECLAMATION PLACE NAMES IN THIS ISSUE

SAFETY

IN CANAL OPERATION

by R. J. WILLSON,
Assistant Operation and Maintenance
Liaison Representative,
Design and Construction Division,
Denver, Colo.

GUARDRAILS FOR PROTECTION.—On the Bufalo Rapids project in Montana, operators who remove trash from the pumping plant trashrack decks have these essential safeguards. ***Photo by S. T. Larsen, Design and Construction Division, Denver, Colo.***

THE BUREAU'S PROGRAM TO REDUCE ACCIDENTS irrigation canals and their related structures s a twofold aim—to protect the general public d water users who visit our irrigation works d to protect the operation and maintenance iployees who must daily and necessarily expose emselves to the ever-present hazards.

Warning signs and protective fences which are ective in protecting the public, are not protecon for the employee who is operating gates, eaning trashracks, or doing repair work. Many ethods are being used and others are being idied to reduce the risk in performing these cessary jobs.

During the last decade, great strides have been ide in the construction of large irrigation works. iese complicated and larger works, however, ve increased the hazards in operating and mainining them. Extra vigilance and the incorporation of new safety measures are necessary if we are to provide the operating employees with the protection they have a right to expect.

What has been done and what is being done on Bureau of Reclamation projects to eliminate accidents to operation and maintenance personnel? We are doing two things: namely, we are trying to educate our employees to follow approved safety practices, and we are installing protective devices.

Along the line of educating our employees, we are emphasizing the importance of "good housekeeping" about structures and alerting the men to watch for safer ways to do their work. The absentminded, careless, or unthinking person is very likely to meet with an accident sooner or later, while the alert, intelligent, and careful individual can work for years under hazardous conditions without getting hurt. Numerous regu-

THIS—

PULLING STOP-LOGS from a check as this operator is doing on the Tucumcari project in New Mexico can become an extremely hazardous operation. Suppose he should lose his balance while handling a particularly stubborn stop-log? Or suppose the catwalk were slippery? Of course, it's all in the day's work. But who wants it to be the last day of his life? *Region 5 photograph.*

WITHOUT THIS—

A CHAIN-GUARDRAIL installed at a wasteway headworks on the Columbia Basin project in the State of Washington can be removed if necessary to permit full access to the working area over the gate bays, but while in position is a protection to operation and maintenance personnel. Other removable guardrails have been installed elsewhere on Reclamation projects. *Photo by S. T. Larsen.*

OR THIS—

A SAFETY BELT is provided on the Riverton project in Wyoming to guard operators handling stop-planks. The belt, spread out for inspection, is normally fastened to the guardrail by rope and chain which slides along the rail between posts. This check is at the head of a high velocity chute. *Photo by S. T. Larsen, Denver, Colo.*

CAN BE FATAL.

ions governing safety practices have been issued cover many activities and these regulations are groundwork upon which sound, safe work bits can be built.

)ur more hazardous structures are being dened with guardrails around dangerous areas the protection of both operators and visitors. t so long ago, a pump operator who was clean- debris from a pumping plant's trashracks pped and fell into the deep water of the fore-. He managed to get out and returned to his rk. But the operating deck was slippery, and debris was so hard to pull that he soon slipped l fell in the water again. After a struggle he out again. Although we admire his persist-e, we regret such a dangerous incident had to ur before the need for protective facilities was arly realized. Needless to say, that particular mping plant is now equipped with a guardrail the trashrack operating deck.

To give better footing on wet, icy, or snow-cov- walkways, steel gratings are being substituted concrete. Metal foot plates with roughened or asive surfaces are being used on stairs and rating decks to provide better traction. To vent falls, wire netting or grating is provided a cover over structure openings. Canal bank rating roads are being surfaced with gravel to nimize skidding danger. Approaches to dges and canal crossings are being clearly rked for better visibility, both by day and night.

For the operator of large valves or gates, a oked bar has been designed. It gives additional erage and the hook assures the user that this trument will not become disengaged, causing n to plunge off the operating platform.

Electrical pumping equipment and switchyards being housed or fenced, thus preventing the neral public as well as the operation and mainance personnel from coming in contact with ve wires" or moving machinery.

Power-operated gates and valves, which elimte excessive physical strain on the operators, replacing hard-to-operate handwheels.

Extra manholes have been provided in many ng reaches of conduit, intake or discharge pipes. hese make access easier and provide better ventiion for those inspecting or repairing the conduit.

A fatal accident occurred at one of our older version dams because the operator was not able to see the sluiceway while operating the gates. In this instance, although warned that a head of water was coming his way, a fisherman, trying his luck in the deeper holes of the sluiceway channel, was drowned. This incident emphasizes the importance of having controls located so that the operator can see what is going on.

SPECIAL SAFETY AWARD is given to H. F. Bahmeier, right, construction engineer for the Bureau of Reclamation's American River division in northern California, by Sergeant George J. Barron of the California Highway Patrol for the safety record compiled during the past year. Government vehicles were driven 250,000 miles in 1952 without an accident. Much of the driving was in rough or mountainous terrain. The presentation was made at Folsom, Calif.

Signs, caution signals, and warning devices such as sirens, bells, and lights are installed where operational hazards exist. Inspection of unsafe conditions is made regularly by qualified inspectors.

Numerous types of escape devices are provided to protect both operation personnel and any others who may be caught in the swiftly moving waters of a concrete lined irrigation canal. Ladders placed at regular intervals on the slopes of concrete canals are a common self-escape installation. Other devices such as cables and floats give any unwary person a greater opportunity to save himself. On many projects, suspended cables with dangling ropes and floats have been installed between side slope ladders, particularly above siphons or inlets to other underground works. On other projects it has been found that trashracks make effective self-escape devices, and safety nets are in common use.

The Bureau is continuing to test and study various devices which will reduce the number of accidents on its irrigation canals. But with all these safety devices we must still use common sense to protect ourselves. ###

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CONTROLLING CORN ROOT WORM DAMAGE as shown by Arnold W. Petersen, at right, is done by spraying at the Nebraska Development Farm. Below, farmers learn from John Schrunk of the University of Nebraska how to adjust one of the many varieties of check dams for head control. *All photos for this article, courtesy of The Hastings Daily Tribune, Hastings, Nebr.*

NEBRASKA-BOSTWICK DEVELOPMENT FARM

by ARNOLD W. PETERSEN, Agriculturist
Kansas River District
McCook, Nebr., Region 7

"How do you like irrigation? Does it pay? What is the cost per acre for land leveling?"

Farmers from miles around ask Willard Stenson these questions and many more like them. Stenson is a "cooperator" on the Nebraska-Bostwick Irrigation Development Farm 5 miles east of Superior, Nebr. This means that he is cooperating with local, county, State and Federal agencies in a combination "know-how" and "show-how" program.

He and his father, Everett Stenson (who bought the farm in 1949 and rents it to 27-year-old Willard) provide some of the general farming "know-how." Irrigation lore is provided by members of an inter-agency group consisting of representatives from the Nebraska Bostwick Irrigation District, the Extension Service, University of Nebraska, Experiment Station, Bureau of Plant Industry, Soil Conservation Service, and the B reau of Reclamation.

Members of this group selected Willard as cooperator in the fall of 1950. They were looki for a farm which had typical development pr lems and a resident-operator who was interest and willing to develop the farm as quickly possible. They wanted to show farmers of t Bostwick Irrigation District how irrigation wou work in the area, if certain recommended irrig tion practices were followed. They also want to try out some experiments in improving the u of irrigation water in the area on a practical, y scientific, basis.

Willard and his father worked out a plan development cooperatively with the committ and have followed it with minor adjustments. 1951 they started using water from the Bostw Irrigation District via the Superior Canal, r cently completed by the Bureau of Reclamati This and other canals to be constructed will p vide irrigation water for lands in the Distr hich are located between Napones and Hardy in uth central Nebraska.

The inter-agency committee, after completing e work plan, delegated one man to work with 'illard. He is Paul Fischbach, the District xtension Irrigation Engineer from the Uni- rsity of Nebraska, who works on irrigation evelopment throughout the Republican River atershed in Nebraska. He often calls upon the xtension Service and the Soil Conservation ervice for technical assistance. The County gricultural Agent supplies advice on crop varie- es, fertilizer requirements, corn root worm con- ol measures, and other recommendations when eded. Technicians from the Soil Conservation ervice made a detailed topographic survey of the rm and estimated the land grading requirements. hey also gave technical assistance in carrying out e actual land grading operations, design of farm ructures, and location of a farm distribution and ainage system.

Stenson and Fischbach are rapidly developing e 97 irrigable acres on the Stenson farm. They ave completed heavy land grading on 51 acres, nd have only about 8 acres more to grade. So far has cost $28.00 an acre for grading the 51 acres. n 1951, they had 63 acres under irrigation and 1952, brought 26 additional acres under water. ext year they will irrigate an additional 8 acres bring the entire 97 acres into production.

Average yields on the farm were good in 1952. he corn averaged 85 bushels per acre, the oats 55, nd the atlas sorgo silage 18 tons per acre. A top ield of 136 bushels of corn per acre was produced n land which had been in sweet clover in 1950 and lanted to corn in 1951 and again in 1952. The eld was sprayed with one-half pound per acre of amma isomer of B. H. C. (benzene hexachloride) or corn rootworm control; 10 tons of manure were pplied to each field in the spring and 45 pounds f available nitrogen as a side dressing at the last ultivation.

The Experiment Station had two corn fertilizer lots in 1952 to study corn yields with and without arter fertilizer and with and without supple- nental nitrogen fertilizer applied at two different imes. Another test was conducted to study the ffect of different application rates of nitrogen pplied as a side dressing to corn at the last culti- ation. Results of these two tests are not avail- ble at this time but will be released by the Uni- ersity of Nebraska.

TESTING STARTER FERTILIZER.—Dr. Mark Weldon, University of Nebraska, showing a group of farmers a test plot of corn during the farm field day held at the Nebraska-Bostwick Development Farm on September 10, 1952.

Apparently soil fertility was a limiting factor in the production of crops under irrigation on this farm. A positive program of legume planting was begun before irrigation water was available and is now being intensified by the planting of a larger acreage of legumes and grasses. In addition, heavy applications of manure and commercial fertilizers (nitrogen) will supplement this program.

Grain, silage, hay, and pasture crops will be fed as needed to the herd of 14 to 20 purebred Guernsey dairy cows Willard maintains. In addition, feeder pigs and cattle will be fattened on the grains and roughage produced in large quantities by the 97 acres of irrigated land. About 47 acres of land above the canal cannot be irrigated unless a sprinkler system is used. This land, formerly in dryland row crops, is being seeded to grass for use as pasture.

The farm lateral distribution system is primarily designed to eliminate permanent ditches. Two basic reasons for following this principle are: (1) Weed control is a problem with permanent constructed ditches; and (2) hand labor is materially reduced by construction of the lateral next to the row crop to be irrigated. A commercial farm

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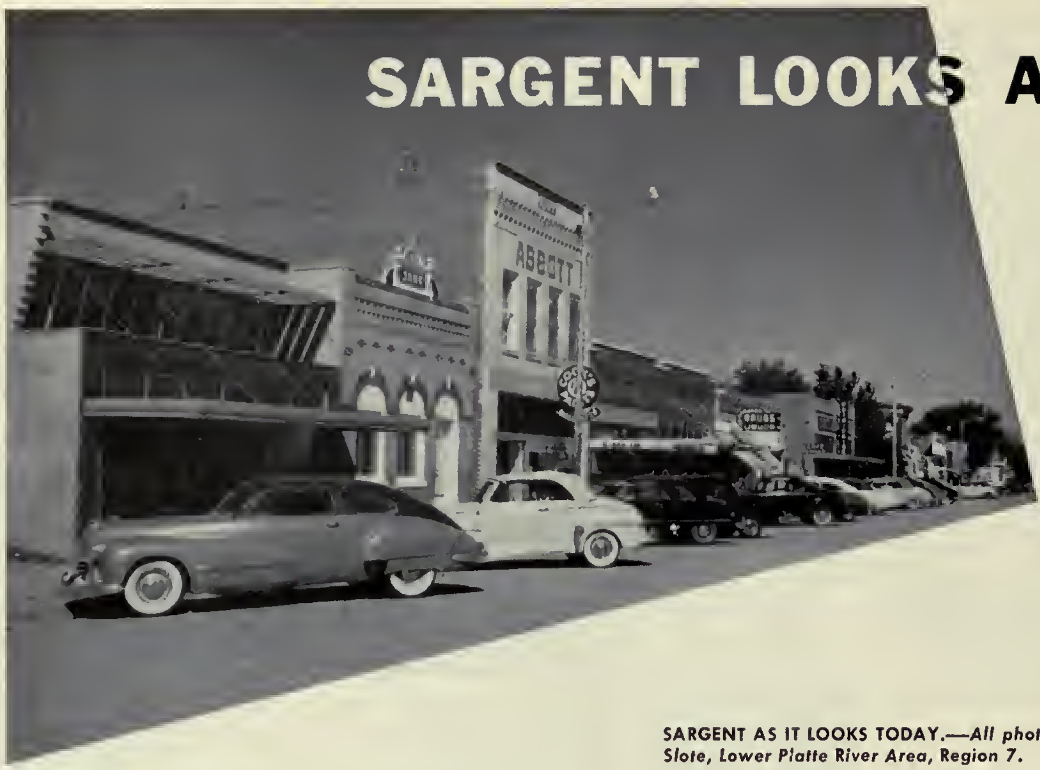
SARGENT LOOKS AHEAD



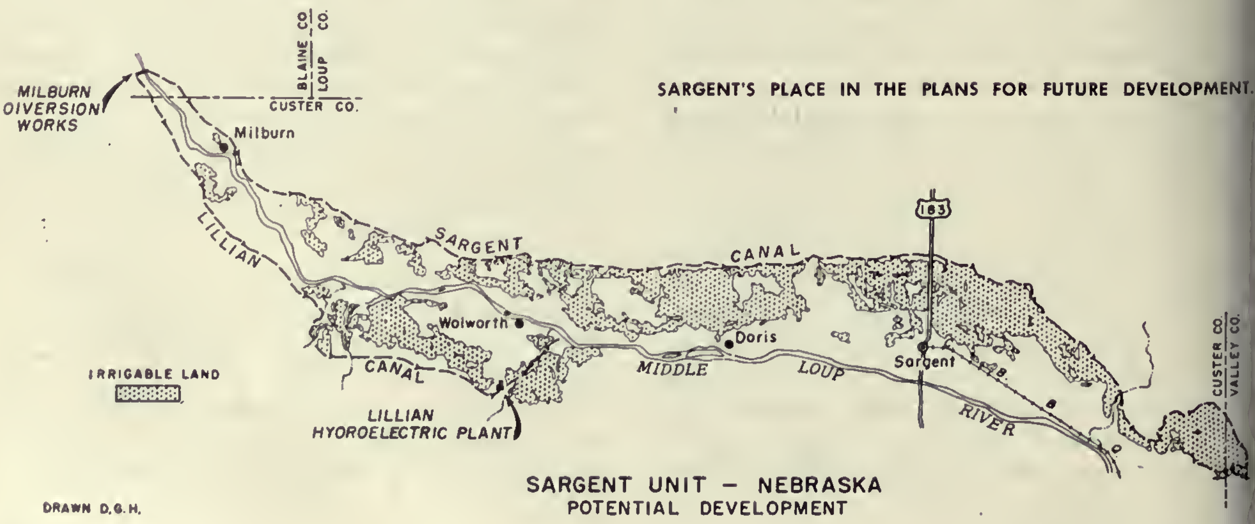
SARGENT AS IT LOOKS TODAY.—*All photos for this article by F. B. Slote, Lower Platte River Area, Region 7.*

by ALDON D. NIELSEN, Agricultural Economist
Lower Platte River Area, Grand Island, Nebr., Region 7

"WE WANT IRRIGATION and we are doing everything within our power to get it," said George Semler on October 30, 1952. Semler, who is vice-president of the Loup Basin Reclamation District and member of the board of directors of the Nebraska Reclamation Association, demonstrated why, by showing us the difference between irrigated corn and dryland corn on the Fred Cole Farm 2 miles northwest of Sargent, Nebr., in the Middle Loup River Valley.

Mr. Cole operates a 440-acre general crop and livestock farm of which 260 acres are cropland. About 75 acres are under irrigation from an 8-inch well having a capacity of approximately 1,100 gallons per minute. Mr. Cole practices a crop rotation of corn and alfalfa. His irrigated corn in 1952, the first year following 3 years of alfalfa, averaged 75 bushels per acre. Dryland corn on the same farm and under similar conditions, ex-

SARGENT'S PLACE IN THE PLANS FOR FUTURE DEVELOPMENT.



ıt for irrigation, averaged only 15 bushels per re. Irrigation in this case was worth 60 bushels r acre, which at the current price of corn in rgent, represents an increase in gross return of 4 per acre. In addition to the direct increase returns per acre, irrigation has served as good urance against the unstabilizing effects of ought upon Mr. Cole's farming operations. veral other farmers in the Sargent community igate small portions of their cropland from lls; however, water-bearing formations through s area in many cases are not conducive to good elds of water and so restrict the acreage that can irrigated. Farmers, when operating under ch limitations, generally irrigate as much of e corn in their rotation as possible since corn ves the greatest immediate response to water in rms of cash returns. Even so, the water application generally is less than the optimum for ximum crop production.

Mr. Semler, now 66 years old, has witnessed a rge and steady flow of high quality water down e Middle Loup River all his life. He has ought long and often of the great production tential of the valley lands if an irrigation sysn could only be developed that would adequately d economically serve the many acres suitable for igation. He has seen farms and farmers "flow wn the river" in the sense that they met ecomic setbacks or defeat as a result of drought hile the old river flowed idly by.

The severe drought of 1894 forced Mr. Semler's rents to return with their three children to their tive community of Durand to seek employment. he trip took 28 days by team and wagon. After ding employment and securing a subsistence for e family through the winter, they returned to rgent in the spring of 1895 and put in their op. Many other farmers met economic distress, situation which has continuously repeated itself mply because irrigation water was not available r the lands and crops of this valley. The Sarnt area has shown a decrease in population ch census year since 1920.

In the early 1940's, George Semler, Jerry Coond (now deceased), Fay Spooner, Rev. Edward . Smith, and others interested in irrigation evelopment, organized the Upper Middle Loup

(Please turn to page 45)

EE FOR YOURSELF," says George Semler, as he visits a field of igated corn (top photo), and then stands in an adjoining field the same crop—but not irrigated.

OPERATING THE COLUMBIA BASIN PROJECT

CLEANING WEEDS FROM A TURN-OUT.—William Amoureaux, ditchrider in the Winchester water section, uses a long-handled weed fork. *Photo by F. B. Pomeroy, Region 1 photographer.*

by E. H. NEAL, Supervisor,
Operation and Maintenance Division,
Columbia Basin Project, Ephrata, Wash., Region 1

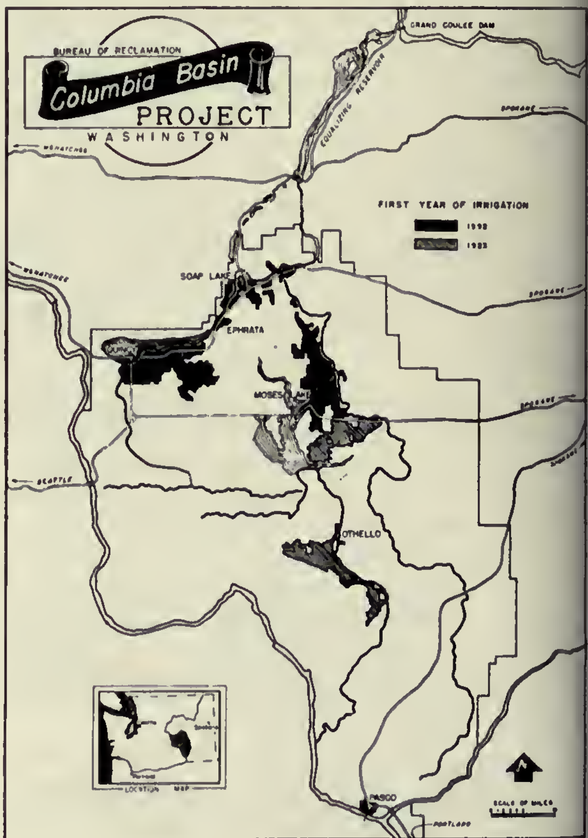
COLUMBIA BASIN PROJECT'S MILLION-ACRE DESERT cannot become an oasis overnight.

It will take about 15 years to construct canals and laterals for irrigating the first 500,000 acres. The end of construction will be only the beginning of a new phase in the development of this giant irrigation project. Many years of careful operation and maintenance will pass before the irrigation system is in full scale operating condition.

Of the 500,000 acres currently programmed for development, only about 67,000 acres at the northern end of the project could be served in 1952. During the next 8 years, as construction progresses, water will be made available to about 65,000 additional acres each year. Each new acre brought in must be taken through the maturing process. At the end of 10 years Columbia Basin project will be composed of areas in 10 different stages of the approach to maturity.

This is not the first year of irrigation operations on the project. Approximately 5,500 acres near Pasco, Wash. have been irrigated since 1948 by water pumped from the Columbia River. Another area of about 1,600 acres near Burbank, Wash., has been irrigated since 1950 by pumping from the Snake River. These areas served as a training ground for this first year of operation of the project's major gravity works. In these areas, proposed water allotment and charge bases have been tested, and costs of operation and maintenance in the project area have been under close study.

We were busy during the winter months getting ready for the beginning of large scale operations. Our first job was to select competent watermasters. With their help we picked and trained experienced operating personnel, equip-



ent operators, and laborers. We had to acquire variety of equipment necessary to effective operion and maintenance. We solved the problem f communications in the previously almost enrely untenanted area by installing a two-way idio system. We placed mobile sets in specified hicles, a major fixed set at the project headuarters in Ephrata, and smaller fixed sets in the irious Watermaster headquarters. We charted e timing and amounts of water diversions, and ographical progress of the testing operations in lvance.

We set up an organization consisting of a Divion headquarters at Ephrata and four Branch eadquarters in the field. The Quincy and the oyal field branches will operate the Main and Vest canals; the Othello and Franklin branches ill operate the East Low and Potholes East nals. Only the Quincy and Othello branches ere active during this year's operations.

We now have 12 Watermaster sections set up operate within the field branches, each section serve about 50,000 acres of irrigable land. The Vinchester, Adco, and Moses Lake Watermaster ctions were put into action to serve those porons of the system being tested this year.

Within the Division Headquarters, we set up Maintenance Engineering Branch, Hydrography ranch, Drainage Branch and Administrative ranch to continue working on the plans, to study

THE FIRST YEAR IS THE HARDEST

STRONG WINDS AND DUST.—Here is lateral between Quincy and Winchester, most obscured by dust. Because of the ght powdery soil in parts of the Columbia sin project, new farmers must keep it control by wetting it down and planting st as soon as they clear their land. ***oto by F. B. Pomeroy, April 30, 1952.***

TUMBLING TUMBLEWEED.— Russian istle, filled the West Canal (large ough to carry the average flow of the linois River at Peoria) almost to the brim, eating another maintenance chore. ***hoto by Dave Roderick, February 15, 951.***

REWARD FOR WORK.—A successful op of potatoes on a farm near Winches-r, produced despite the difficulties of utting raw land into production, through e efforts of the farmers and operation d maintenance staffs. ***Photo by F. B. omeroy, July 16, 1952.***

. AT THE "NERVE CENTER."—E. H. Neal, uthor of this article, seeing to it that ater gets to the farmers when they need . ***Photo by F. B. Pomeroy, May 9, 1952.***

the jobs being done and to be done, and to fulfill the immediate administrative requirements.

On March 10, 1952, the Watermaster opened the gates at Dry Falls Dam near Coulee City. Water flowed into the project's Main Canal, and the first season of large-scale irrigation operations began. The operating forces had quite a job laid out for them during the first season. They had to test about 100 miles of major canals and over 150 miles of laterals, as well as a number of relift pumping plants and mechanically operated control gates. We designated 1952 the official "Testing Year" for the portions of canals and the laterals being brought into operation. Actually this basic job was further complicated by the inrush of settlers to the basin's new farms. During the season, water was delivered for the first time to about 450 new farms.

Confining quantities of deep, swiftly flowing water within banks of dry earth, even when some of those banks are protected by linings, is a tricky business at best. Naturally, therefore, this first season's operations were closely and anxiously watched. Ditchriders patrolled major canals 24 hours a day. Equipment and men were kept ready, like a fire brigade, to concentrate at any point of need. However, in general the season passed with only the expected minor breaks, leaks, and washouts on smaller unlined laterals. Only one break of consequence occurred on the East Low Canal. Fortunately, crews were able to repair it swiftly and prevent significant damage to crops in that area.

The year was not without its problems, however. Service roads were inadequate for quick movement of equipment and men. Ditchbanks were dry and bare of vegetation. Delivery to new farms in some areas required increase of velocities and raising of water surfaces in laterals and canals beyond what was considered safe, and caused some scouring of the banks. An extended period of high winds in some areas produced erosion of newly tilled farm lands and unprotected ditchbanks. Canals and laterals were convenient catchalls for several varieties of rolling and tumbling weeds, which jammed structures and turnouts and increased the difficulty of water regulation and delivery. Thus a large part of the operating personnel were kept busy building and repairing roads, seeding ditchbanks to grasses, rip-rapping ditchbanks to prevent their washing away, sometimes reexcavating laterals filled with windblown soil, and repairing a variety of leaks and washouts.

Throughout the year the number of farms under development steadily increased. By the end of the season, more than half of the platted farm units in the areas for which water was available had received delivery of water. On about 450 farms about 21,000 acres were actually cropped. Returns varied from complete failure (a small acreage) to over $1,000 per acre.

Columbia Basin farmers in the areas being tested this year, bought irrigation water by the acre-foot. The price varied, depending on the productivity rating of the lands within the particular farm. Each farmer could use as much or as little water as he wished. In the future, each water user, by paying the tax assessment for his farm, will be entitled to a base quantity of water. The amount will be figured on the estimated water requirement for lands in his particular farm. Additional water will be sold at rates which increase with each acre-foot per acre used.

In a few years, water lifted by pumps from the Columbia River at Grand Coulee Dam and impounded in the Equalizing Reservoir above Dry Falls Dam will be used to irrigate farm lands near Pasco, almost 160 miles from the big pumps. More than 7,000 new farms will be served by the East Low and West Canals, and by canals from the Potholes Reservoir situated in the center of the project.

This year has provided a preview of the requirements of future years. The irrigated areas will now grow at a predetermined rate, year by year. With the proper combination of men and machines for efficient maintenance, the giant irrigation system will provide efficient, economical service to thousands of farms—once wasteland. ###

BUILDING UP THE LEVEES.—*All photos for this article by Herbert Huffman, San Joaquin Valley District.*

AT CHOWCHILLA

How Local-Federal Cooperation Pays Off in Cutting Costs, Speeding Construction and Delivering Central Valley Project Water

by JUDGE H. V. EASTMAN,
Secretary-Manager, Chowchilla Water District,
Chowchilla, Calif.

One night in the summer of 1947 a serious group of landowners met in a country schoolhouse near Chowchilla, a farming community in the San Joaquin Valley of California.

They met to discuss, and seek a solution to, a problem so vital that it threatened successful operation of their farms and the continued existence of their community. Chowchilla is in a semi-arid region with little winter rainfall and none in the summer. Crops must be irrigated repeatedly. Hundreds of wells, equipped with electrically operated pumps, were the sole source of water for domestic and irrigation supply.

The meeting was called to consider the serious situation resulting from rapidly falling water levels in most wells, with the necessity of drilling deeper wells and installing larger pumps. Even these measures, which were costing the community more than a half-million dollars yearly, gave only temporary relief, as the underground water level continued to fall.

While supplemental water from the Central Valley project, then under construction by the Bureau of Reclamation, had long been heralded as a source of supply to save Chowchilla's farms, the chance that this added water might be received in time to bolster the community's sagging economy seemed remote. The farmers in that evening meeting knew that Chowchilla's lands were a part of the Madera Irrigation District. While the Madera district had entered a contract for Central Valley project water some 10 years earlier, a new water service contract must be negotiated and arrangements made for the construction of a distribution system to serve project water to the district's lands. The cost of the proposed system and differences of opinion were contributing to endless delays—delays which the Chowchilla area of the Madera district could not afford.

At the meeting it was brought out that water was then available at Friant Dam, some 40 miles to the south of Chowchilla, and that limited service could be obtained immediately through the project's Madera Canal, providing existing streams traversing the Chowchilla area could be used to distribute the canal flow.

Determining then that they must have earliest action, the farmers in that evening meeting resolved to solve their problems by cooperative action and appointed a committee of 25 to plan a program and hurry up the delivery of CVP water.

Duval Williams, a long-time advocate of the Central Valley project, was made chairman, and I, H. V. Eastman, the local judge, was appointed secretary. For nearly 2 years the committee worked on the problem and finally concluded that it would be necessary to get out of the Madera Irrigation District and form a new district if early results were to be obtained. The Madera district eventually would solve its problems, but water conditions at Chowchilla needed immediate action.

With general plans laid, more committee work followed. Money for expenses was raised by subscription, petitions to withdraw from the Madera district circulated, and other petitions, to form a new district, were signed by hundreds of property owners. Assurance of a water supply had to be obtained from the Bureau of Reclamation and definite plans made for distributing water to farm lands.

The Bureau was willing to build canals for the proposed district, but the committee decided upon locally-built and locally-financed canals and, because of the geography of the area, it has been possible to work out a unique plan of canal and lateral construction and operation, through cooperative action of individual farmers, landowner groups, improvement and water districts, which has brought adequate water to the Chowchilla community at minimum construction and operating costs.

The amazing spirit of unselfishness and cooperation of an entire community and the helpfulness of Bureau of Reclamation representatives have been important factors in solving the area's water problems and in achieving the substantial results which already have removed the threat which was hanging over the community only 5 years ago.

The Chowchilla Water District was organized in February 1949, embracing 63,000 acres of fertile farm lands. The district promptly negotiated a contract with the Bureau of Reclamation and, although just formed, was the first district in the valley delivering Central Valley project water.

The Chowchilla district was allocated 2 acre-feet of project water to supplement its existing underground supply. This is not enough for complete surface irrigation and it was planned that only about half of the land would receive canal irrigation. It was expected that with this land no longer depleting underground water, levels would

AT CONTRACT SIGNING: (Figure 6 at right) left to right, seated, Ralph M. Brody, Assistant Counsel (Bureau of Reclamation), Region 2; District Manager (B. of R.) Jack W. Rodner; Duval Williams, Chowchilla Water District; Regional Director (B. of R.) Richard L. Boke; Frank Justin, President, Chowchilla Water District. Standing, Attorney Denslow Green, Chowchilla Water District; Secretary H. V. Eastman; CWD Directors Charles Blaylock, H. P. Dower and Mark Van Elswyk; B. of R. engineer Howard S. Stoddard.

rise promptly and the other half of the district would continue to use pumps, with improved water levels and lower pumping costs. Cost of water to the entire district would be as nearly as possible equal, with district taxes and water charges so fixed as to achieve this result.

Project water is received from Madera Canal of CVP into Ash slough, and from that stream, into Chowchilla River and Berenda slough. Both project water and natural flow are delivered in

4

5

6

COOPERATION IN ACTION

LDING A CANAL.—Twenty-eight own- ,200 acres of land in the Chowchilla District banded together to form an ement district and build this Justin Extension, which will carry 30 cubic water per second to their properties. ter District operates the dragline. The d farmers pay the costs through the ement district.

ING A DITCHER.—Ten farmers pitched uy this elevating ditcher when farmer in Chowchilla decided to build lat- bring Central Valley project water e Chowchilla District's main canals to rms. After the first group used the for their own lateral, they offered it charge to other groups to use for g canals in the district.

ING MONEY.—When offers by con- for constructing a diversion works to the flow of water from Berenda Slough a Canal were too high, the District de- build the structure with its own main- forces. They are completing the work half the cost offered by the contractors.

LDING A DIVERSION DAM.—The hilla Water District just completed this tructure, Chowchilla's main diversion which replaces sand dams formerly divert and control the stream flow of hilla River and Ash Slough. Water hese streams, supplemented by that d by the Central Valley project, di- rrigates half the 63,000 acres in the . The remaining half is watered by from the underground reservoir which g rapidly replenished now that CVP s available.

OSTING THE COMMUNITY.—Decora- long the main street of Chowchilla, proclaim that the holiday season of s a happy one for a community which lved its water problems through coop- .

ING TIME.—Although the Chowchilla District was one of the last to be or- d in the San Joaquin Valley, it was the deliver Central Valley water.

these streams, which are used as main canals through the district. For many years these streams carried flooding mountain water, which built up plains, so that the stream beds are higher than surrounding land. Water is now diverted into lateral canals with sand dams of inexpensive structure. The main channels and diversion works were built by the district.

About 80 miles of canals tapping these streams have been built in 4 years by groups of farmers, sometimes with local equipment and at times by contractors. All construction costs have been financed locally and no public funds have been used. A variety of plans were used by the different farmer groups who built canals. In some cases all of the affected farmers have signed agreements to pay a proportion of the costs and to furnish canal rights-of-way without charge. Three mutual water companies were organized to build canals. Three improvement districts were formed to finance three canals. Some canals were built with only verbal agreements and no trouble has occurred as a result of these informal arrangements. All of the canals are now being operated and maintained by the Chowchilla Water District in order to assure uniform operation and care.

Practically all canal rights-of-way have been furnished without charge by landowners. The district furnishes engineering and legal help without charge to all groups who build canal laterals and will also arrange for construction funds when necessary. All concrete structures and most of the canals are of standard design. Howard A. Stoddard, formerly with the Bureau of Reclamation, is the district engineer. Canal costs have averaged less than $15 per acre for the entire district in a section where distribution systems are costing several times that amount.

Farmers Guarantee $50,000 In Advance

A highlight in the history of the district came when 25 farmers guaranteed payment for $50,000 worth of water for the entire community before the district was formed. Another time 10 farmers paid for a large elevating ditching machine and loaned the machine to any group who wanted to dig a canal.

Well measurements show that after operating for 4 years the underground water level has risen over more than 80 percent of the district—as much as 30 feet in some areas.

The district has carried on an extensive building program since the close of the 1952 irrigation season to provide permanent diversion dams to control the flow of water into the streams used as canals. This work is being done with local help or small contractors and the total cost will not exceed $40,000, which represents about 65 cents an acre for the district lands. The district is also helping to repair stream banks at points where winter floods may overflow them. These projects will complete all of the major improvements necessary to put this district in a sound operating condition.

Partly because of the cooperative spirit shown by landowners, the district has functioned with less difficulty than has appeared in some districts, and very few problems have developed in using Central Valley project water. The group of determined farmers who met in a Chowchilla schoolhouse in the summer of 1947 have carried forward a program, then sketchily outlined, which has ended the threat of water bankruptcy to their farms and their community. ###

Seeds of Wealth

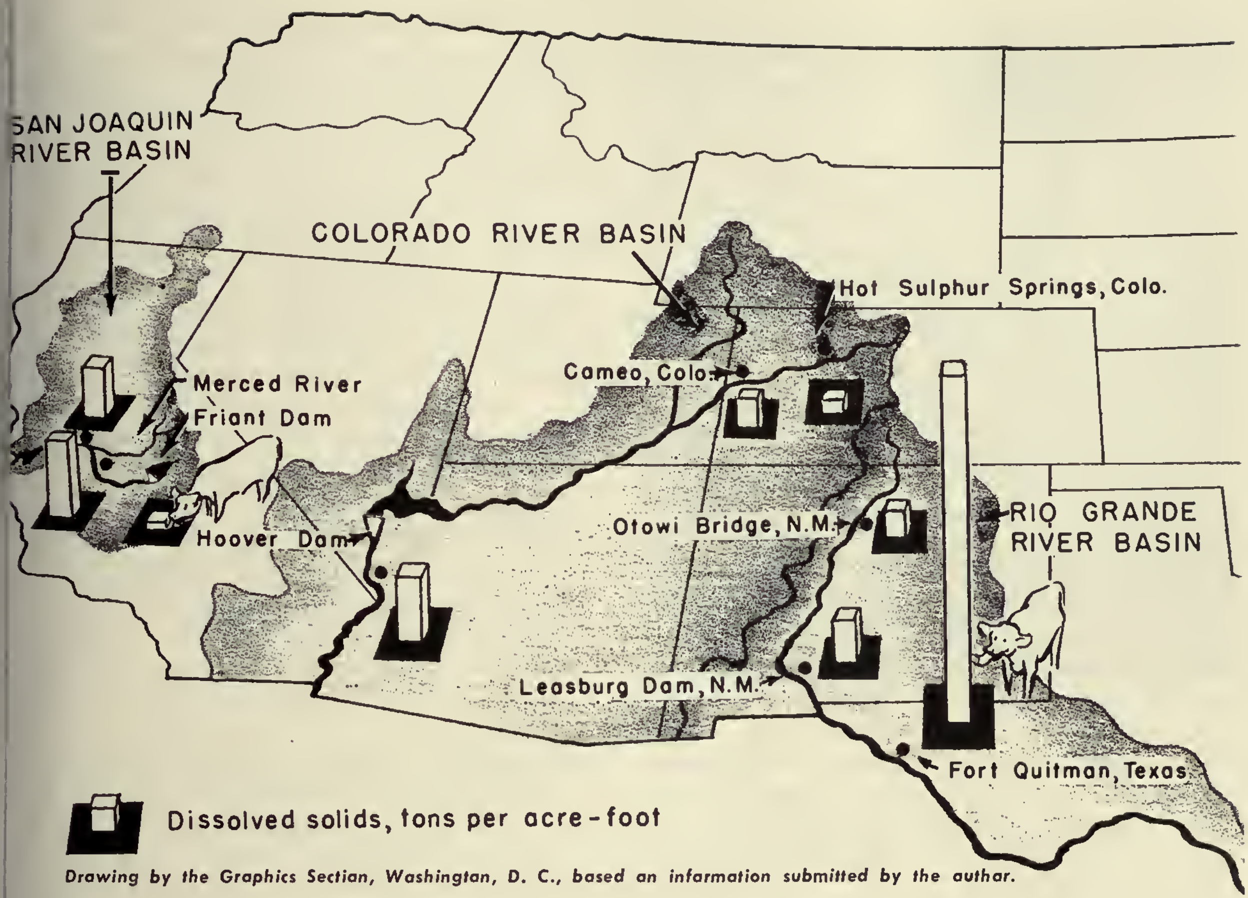
The contribution in indirect taxes made by lands on Federal Reclamation projects is well illustrated in a report by the Crookham Co. of Caldwell, Idaho, the Nation's largest producer of hybrid sweet corn seed.

The firm has engaged in seed production since 1930 when hybrid corn was first used. For the past decade approximately 4,300 acres annually have been planted to seed crops for the company. During this 10-year period the company has paid taxes of all kinds at the rate of $17 per acre each year, or a total of $731,000 for the entire area.

In addition to these payments, taxes are paid by the farmers on whose land the crops were grown, by the truckers, combine operators, and by the many service industries.

The Federal investment in facilities needed to serve the seed-producing land of the company amounts to between $450,000 and $475,000, all of which will be repaid by the water users, without interest.

The company president, G. L. Crookham, Jr., a great booster for expansion of irrigation says, "To be sure I don't like taxes any better than the next fellow. But tax money invested in Reclamation projects has proven to be a good national investment." •



Drawing by the Graphics Section, Washington, D. C., based on information submitted by the author.

IRRIGATION AND WATER QUALITY

Part 2—Quality of Water in Selected Basins

by C. S. HOWARD, Regional Chemist,
Quality of Water Branch, Geological Survey,
Salt Lake City, Utah

Practically all streams show a progressive increase in dissolved solids concentration from the headwaters to the mouth. Much of the increase is due to water coming in contact with natural, calcareous, or gypsiferous soils and dissolving large quantities of this material, thus increasing the hardness of the water.

Waters draining from a region with soils containing large quantities of soluble sodium salts will be less suitable for irrigation of certain soils because of changes in soil characteristics that affect the percolation of irrigation waters. The use of water for irrigation causes additional increases which may be of considerable importance.

When drainage and waste waters enter a full, flowing stream the incoming waters may be diluted. This dilution is needed as much for irrigation returns as it is for other types of wastes. The possibility of dilution will be less as more projects are developed and the water is reused over and over again. Water users along certain streams are concerned over the increasing practice of diverting water from the headwaters into another drainage basin. Although no computations have been made to show the changes that may be expected as a result of these diversions, it seems certain that significant effects on the water quality will result in basins where the water is used and reused many times.

The quality of certain waters in the State of Colorado in the early 1900's was discussed by Headden who showed that the supply for the city of Fort Collins had quite a variation in dissolved solids concentration. The supply was from the Cache la Poudre River and during periods of low flow the water was largely seepage from irrigated lands. The Department of Agriculture has studied the quality of irrigation waters and the changes that take place in many irrigated areas. In these studies an attempt is made to determine the quantity of dissolved solids going into, and the quantity removed from, an irrigated area, for the computation of the "salt balance." The balance is said to be unfavorable when the quantity of salt that enters the project is greater than the quantity removed. Conversely, the balance is favorable if more salts are carried out of the project in the waters than was carried into the project. Such studies and computations are of importance to those using water in the area because the results indicate whether salts are accumulating in the irrigated lands. The results are also of importance in that they show the change in concentration and chemical character of the water available for irrigation and other uses downstream.

Recent studies in the Yakima Basin have shown a favorable salt balance for the Sunnyside District, but the analytical and computed results show that large quantities of dissolved solids are brought into the Yakima River as a result of irrigation practices. These solids will affect the usefulness of the waters of the Yakima and to a very slight extent the quality of the water of the Columbia River, to which the Yakima is tributary.

Large irrigation developments in the San Joaquin Basin in California use water from the San Joaquin River and some from the Sacramento River. Analytical results for the San Joaquin show considerable changes in the water quality with the concentration of dissolved solids increasing downstream. It appears that some of the tributaries (for example Merced River) may dilute some of the dissolved solids in San Joaquin River water. The presence of large areas in which there are appreciable quantities of soluble salts will be a source of soluble salts for the drainage water from the land and for the waters of the stream.

For the Rio Grande the dissolved solids content of the river water increases progressively downstream and records of the Department of Agriculture show that the concentration of dissolved solids of the Rio Grande at Fort Quitman, Tex., is more than 16 times the concentration of dissolved solids in the river at the Otowi bridge, about 90 miles below the Colorado-New Mexico State line. For many years unfavorable salt-balance conditions have existed in parts of the Rio Grande Basin, but in 1949 due to increased rainfall, the salt-balance conditions were favorable throughout the basin.

In some developed areas in the Colorado River Basin, signs of accumulation of soluble salts because of poor drainage are visible and some tributaries bring in waters of relatively high concentration which are of no value for the dilution of drainage waters. The effects of storage in Lake Mead have been discussed previously, but it should be pointed out that Lake Mead, in addition to regulating the flow of water, also regulates water quality. Storage has decreased the range in concentration of dissolved solids of the water in the lower Colorado River. Much of the irrigation in the Lower Basin is done at a time when the normal stream flow is lowest and the mineral content of the water of the unregulated stream is highest. Storage has produced a fairly uniform concentration of dissolved solids, and the water users in the Lower Basin are now applying water with a lower average concentration of dissolved solids than that which they had before the river flow was regulated.

The possible effect on water quality through irrigation practices often has not been recognized possibly because of the difficulty in determining actual changes due to irrigation practices. There are few legal documents that mention water quality, but it is likely that discussions leading up to the preparation of river compacts may have considered the effects of irrigation practices on water quality. It seems, however, that more information is needed concerning the effects of irrigation on water quality and steps should be taken to improve irrigation practices to lessen the harmful effects of such practices.

NEXT MONTH—

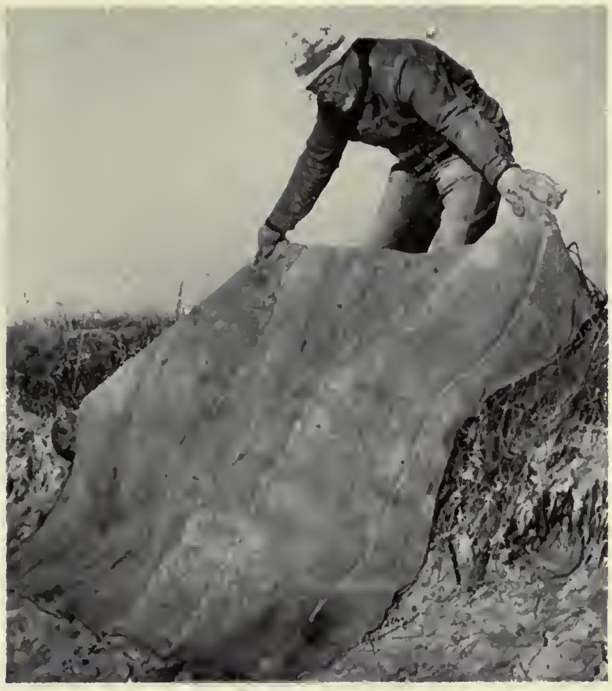
DON'T GAMBLE ON WATER QUALITY!

Plugging Holes With Canvas Dams

The unique emergency truck used by the Twin Falls Canal Co. in Idaho, as explained in a recent issue of the Era, has its smaller counterpart on the ...lder Irrigation District of the Boise project.

Two of its ditchriders carry with them at all times a 6-foot square section of heavy dam canvas to plug leaks caused by gopher and badger holes, which are perpetual trouble spots on most reclamation projects. In the past year ditchrider William ...wler states he has used the canvas three times where shoveling dirt would not have stopped the leak.

Lawler, a 32-year veteran on the job, explains that where the velocity of the water escaping through the break is fast, he drives sticks vertically into the ditch bank to prevent the canvas from being sucked through the hole. He does not recommend using rubberized canvas. It is too stiff. •



Nebraska-Bostwick Development Farm

(Continued from page 29)

...cher is pulled behind a farm tractor to cut the laterals when and where needed. All of the farm laterals are temporary except on an 800-foot section which is on a 2 percent slope. A series of drop structures were used to bring the water down the slope without erosion. All temporary laterals were laid out on a grade of 0.05 to 0.10 feet per 100 feet in order to eliminate all but a few check dams and assure uniform operation of siphon tubes. Studies have been made by the Division of Irrigation, U. S. Soil Conservation Service Research, and the University of Nebraska to determine proper irrigation practices for this and similar farms in the Republican River Valley. This information is now being summarized and will be used by local technicians for making recommendations to farmers.

Briefly, the following irrigation principles were followed on the Stenson farm: (1) water applications were made when the top 4 feet of soil reached 50 percent of its available moisture. This was determined in the field by use of a soil auger; (2) the size of irrigation heads was varied to prevent erosion; (3) the initial irrigation head was set so that the water would reach the end of the run in one-fourth of the total time required for the irrigation application. The size of irrigation heads was cut back after water had reached the end of the run in order to prevent excessive runoff loss.

The corn was irrigated twice during the 1952 season, with a total application of 12 inches. Two inches of water were applied to the oats in June. Atlas sorgo received 16 inches of water in two applications.

In order for the public to have a chance to view the crops and receive first-hand information from the technicians, farm field days were held in 1951 and 1952. On September 10, 1952, approximately 250 farmers gathered at the Stenson farm. Specialized irrigation equipment was inspected in the morning. A lunch was served by the Superior Chamber of Commerce at noon. Immediately after lunch, a short speaking program preceded the field inspection of the farm. Five stops were established at points of interest on the farm, with a speaker assigned to each.

When Willard Stenson is asked, "Do you like irrigation?" he replies, "Yes, I like irrigation and it pays too. I can now follow a good soil improvement and fertilizer program on my farm without fear of drought. I would hate to go back to dryland farming after my experience with irrigation."

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NEW FACES FOR DAMS

by Lewis M. Ellsperman, Engineer,
Design and Construction Division, Denver, Colo.

BONNY TEST—The upstream face of the test embankment at Bonny Reservoir in Colorado. The dark material at left is asphaltic concrete; the lighter material at right is soil cement. Photo by J. R. Benson, Denver, Colo.

It looks like a washing machine on the outside. If you looked inside, you might be reminded of a Ferris wheel. But it is neither a domestic nor a recreational device. In the Bureau's testing laboratories in Denver, it provides a practical, economical way of finding satisfactory substitutes for the rock riprap customarily used to protect the slopes on the upstream faces of earth dams and embankments.

Traditionally, riprap—massive pieces of hard, durable rock placed over the slope to depths of 3 feet or more—is widely used on the upstream faces of earth dams for protection against wave action in the reservoirs and against other natural destructive forces. For dam faces on the Great Plains, rock riprapping must now be obtained from sources 50 or more miles away. At some sites, Reclamation would have to haul rock by train or truck up to 400 miles, making riprap an expensive part of dam construction. For example, on Bonny Dam, an earthfill structure on the Missouri River Basin project near the Colorado-Kansas border, about 500,000 tons of rock and gravel were quarried near Golden, Colo., trucked to Boulder, loaded on railroad cars, shipped to Burlington, Colo., and finally trucked to the dam. Transporting such materials 250 miles is extremely expensive.

Designing protective surfaces for the upstream faces, or slopes, of earth dams is a difficult task. These slopes go through continuous cycles of wetting and drying and freezing and thawing. They are steadily pounded by reservoir waves, and the grinding produced by sand in the wave-borne water all challenge the durability of even the strongest protective cover. The treble assault of weather, wind, and wave must be analyzed and evaluated in selecting proper protection for a dam's face.

The effect of waves on earth slopes and methods of predicting wave action have particularly occupied the attention of many scientists. Expensive machines costing hundreds of thousands of dollars have been built by other interested organizations to generate waves for use in studying the phenomenon of wave action in beach and channel erosion.

The Bureau's researchers in the bituminous laboratories needed some such machine to simulate wave action in their study of substitute materials for rock riprap. But the costs were prohibitive. Accordingly, they built their own wave-producing apparatus—not at the price of $400,000 that one large machine reportedly cost, but at the nominal price of $500.

This device is in effect a washing machine, not unlike that found in the average home. It is a compact unit—a watertight metal tank, about 4 feet square and 3½ feet high. Depth of water in the tank is held at 20 inches. A horizontal shaft extending through the tank at its midpoint is revolved by a small electric motor. The drive mechanism turns the shaft at 40 revolutions per minute. Three equally spaced steel rods, 30 inches long, are rigidly welded around the shaft. At hed to each rod are six brass holders which turn hold the samples of asphaltic concrete ng investigated. Thus, 18 specimens can be ted at one time. The brass holders are designed permit rotation on the rods so that the faces the specimens strike the water surface at any sired angle.

Asphaltic concrete is a mixture of asphalt and nd and a small amount of gravel, mixed hot at a nperature of about 300° F., compacted by heavy essure, and then cooled. The end product is a igh, dense, impermeable, durable material. The phaltic concrete specimens used in the laboratory e molded at a temperature of 265° F. on a hy-aulic press; various loads for compaction are ed to produce both high and low densities for ch asphalt content. The sand and gravel used e obtained from deposits near the dam sites iere asphaltic concrete may be used as a protec-e cover.

Specifically, the "washing machine" is used to aluate the durability of specimens of asphaltic ncrete under continuous spanking induced by e revolving mechanism. The machine operates a 24-hour day, 7-day week basis. In a week's ne it is possible to deliver approximately 400,000 ows to the specimens; a revolution counter at-hed to the shaft keeps an accurate account of e grueling punishment administered to the ecimens. Certain samples tested have success-lly withstood the steady pounding of 26,000,000 ows; other samples show considerable erosion d deterioration and have been rejected for use in nstruction.

Confirmation of the laboratory work is being rried out on a full-scale basis. A test section nstructed on the shore of the Bonny Dam reser-ir is faced with various thicknesses of asphaltic ncrete previously studied in the laboratory. cal sand and gravel were utilized in the mix. n the "washing machine" this material success-lly withstood the effect of 7,000,000 blows.) e test section is being subjected to freezing and wing, wind and wave action, reservoir draw-wn, and other severe service conditions. So far, e asphaltic concrete test facing has been satis-ctory. An alternative substitute facing, soil ment, is also being tested on the Bonny test bankment and is likewise showing promising sults. (Soil-cement is a mixture of portland ment, soil, and a small amount of water for tting.) Like asphaltic concrete, soil-cement makes use of materials generally available at or near the site.

Because of good results in the use of asphaltic concrete as demonstrated by the laboratory experiments and by the Bonny test section, Bureau engineers have called for its application on Glen Anne Dam, an earth-fill structure on the Cachuma project in California. On the basis of alternative bids received, the cost of placing asphaltic concrete was $26,000 less than the cost of furnishing and placing riprap on the upstream face of the dam.

Water users can now look forward to major economies in earth dam construction throughout many areas of the west where rock riprap is at a premium. ###

PRE-TESTING SUBSTITUTES FOR ROCK RIPRAP.—At top, engineer L. M. Ellsperman places an asphaltic concrete specimen in the "washing machine." After the specimens have been assembled, the glass top is closed, and the electric motor, at left, is started up. Immediately above, an inside view of the full fury of wave action in the laboratory-built testing machine. ***Both photos by W. M. Batts, Denver, Colo.***

DOUGLAS McKAY—

The New Secretary of the Interior

Douglas McKay, the new Secretary of the Interior, is not new to public service, having been elected Mayor of Salem, Oreg., for a 1-year term of office in 1933, Oregon State Senator for four terms of 2 years each (1935–37; 1939–41; 1943–45, and 1947–49), and Governor of the State of Oregon since 1949. He has also served as a first lieutenant in the infantry, Ninety-first division, during World War I, being decorated with the Purple Heart for wounds received in France, and as a captain and major in the Service Command Unit during World War II.

Born in Portland, Oreg., June 24, 1893, he lived in Portland's Albina district as a child, moved to Castle Rock, Wash., where he entered school, but returned to Portland to begin the third grade. He began to work to support himself at the age of 13, working his way through Lincoln High School and Oregon State College by selling candy, newspapers, driving a butcher wagon, working as a janitor, an office boy for the Union Pacific Railroad, and an agent for a laundry. He found time to be president of his freshman class and was graduated from College in 3 years, receiving his B. S. degree in agriculture in 1917.

For 7 years (1920–27) he worked as an automobile salesman and sales manager in Portland, and established his own automobile business i 1927.

Long before he sought public office Secreta McKay began working for northwest develo ment. Almost as soon as he was elected to t State Senate he was appointed to the Willamet Valley Basin commission which concerned itse with valley flood control and irrigation. Many the committee's recommendations have been em bodied in the Federal Willamette Valley projec which are designed to alleviate damage from a nual floods which wash away precious topsoil fro verdant valley farms. As State Senator, Dougl McKay also was chairman of the committee roads and highways. He was a member of t Port of Portland development committee althoug a Salem resident. As Governor, he regularly a tended the meetings of the Columbia Basin Inte Agency Committee, taking an active part in t discussions and seeking compromises betwe divergent interests on controversial issues.

The McKay family has lived in Oregon mo than 100 years. The new Secretary is the son E. D. McKay and Minnie A. Musgrove McKa He married Mabel Hill on March 31, 1917, a has two daughters, Mrs. Wayne Hadley and M Lester D. Green. He is a member and pa president of the State Automobile Dealers Association, member and past president of the Salem Chamber of Commerce, member and past president of the Oregon State College Alumni Association, member of the Veterans of the Foreign Wars, Sons of the American Revolution, Disabled American Veterans, the Masons, Eagles, Elks, and Phi Delta Theta.

Upon learning of Governor McKay's designation as Secretary of the Interior, Oscar L. Chapman wrote on November 24, 1952, as follows:

"My Dear Governor McKay:

"I was very glad to learn of President-designate Eisenhower's intention to appoint you as the new Secretary of the Interior. It was particularly satisfying to me to know that my successor will be someone who is as thoroughly acquainted with the problems of the West, and who has the deep interest in the conservation and development of the Nation's natural resources as I know you have.

"I want you to know that it is my desire to do everything I can to facilitate the orderly transition of the responsibilities for the work of the Department from my hands to yours. The facilities of the Department are available to you for this purpose, and I shall be very happy to sit down with you, or with whomever you designate, at a time of your choosing, in order to discuss these matters.

"Again accept my heartiest congratulations on your designation.

"Oscar L. Chapman,
Secretary."

Governor McKay replied on December 1, 1952:

"Dear Secretary Chapman:

"Your kind letter of November 24 and your recent telephone call are sincerely appreciated.

"The friendly offer of cooperation and assistance in effecting the transition of the responsibilities for the work of the Department of Interior is a valuable contribution in my assumption of the position. I am looking forward to the opportunity to have an extended conversation with you as soon as the time element can be worked out to our mutual convenience.

"Thank you again for your thoughtfulness and for your good wishes on my appointment.

"With kindest personal regards, I am

"Sincerely yours,

"Douglas McKay,
Governor."

The new Secretary arrived in Washington, D. C., on January 7, 1952, to confer with members of Congress, Oscar L. Chapman, Interior Department officials, and others concerned with the transfer of functions to Secretary of the Interior Douglas McKay. ###

Sargent Looks Ahead

(Continued from page 31)

Promotion Club. Most of the members contributed $100 each to promote the irrigation interests of that general area. This group in 1944 requested the Bureau of Reclamation to make a detailed investigation of the potentialities for developing the water resources of the area.

As a result of detailed planning studies, a plan is proposed for development under the Sargent Unit of the Missouri River Basin project. This plan would provide for the irrigation of 17,560 acres of irrigable land and for the average annual generation, over a 50-year period, of more than 26 million kilowatt-hours of electrical energy, utilizing the direct flow of the Middle Loup River. Features to be constructed include the Milburn Diversion Works, Sargent Canal, Lillian Canal, Lillian Hydro-electric Plant, and the Sargent and Lillian distribution and drainage systems. The initial construction would include the Milburn Diversion Dam, Sargent Canal, and related distribution and drainage features to irrigate 13,740 acres of land located along the north side of the Middle Loup River from Milburn to the Custer-Valley County line.

"We can't afford to further delay or lose this opportunity for developing our resources," says Mr. Semler. Irrigation water on the initial 13,740 acres in 1952, if all in corn and at current prices, would have produced and increased gross return over dryland production equal to 75 percent of the current estimated construction cost of the distribution and drainage works. Annual benefits under full development would accrue directly to the water users in the form of increased cash returns and an accumulation of equity in the farm investment. Indirect benefits would also accrue to non-water users in Sargent and the surrounding trade territory in the form of increased profits to retailers, wholesalers, processors, and all other enterprises handling goods and services resulting from increased agricultural production. Additional population and increases in total assessed valuation of property would facilitate the provision of improved community facilities and services. The economic status of the businessman in town as well as that of the farmer would become more stable.

Having recognized the tremendous benefits that can be created through the development of irrigated lands, there is no doubt as to the course of action that should be followed. Farmers and businessmen alike have been sharing the responsibility of bringing water into use on the Sargent lands. Approval for the formation of the Sargent Irrigation District was granted by the landowners in the November 1952 election. This district is recognized as a legal entity for contracting with the United States Government for development of the project. Upon completing negotiations for a repayment contract and receiving the "go-ahead signal" from the Congress, a dream of wise water resource development will come true for the local people, and they can take their place as a comunity that has felt the magic touch of water and the pulse of economic and social well-being that accompany it. ###

Four-States Irrigation Council Meets

The Four-States Irrigation Council which was formed last January (see page 66 of the March 1952 Reclamation Era) held its second annual meeting on January 14–15 at Fort Collins, Colo. Operators of all irrigation and hydroelectric systems in Colorado, Wyoming, Kansas and Nebraska were invited to attend. The Era hopes to have the privilege of publishing more news about this progressive group. •

Klamath Settlement Announced

Approximately 6,700 acres of the 59,000-acre public land area which lies both in the Klamath and Tule Lake Wildlife Refuges and the Klamath irrigation project in Oregon and California will be opened for homesteading as soon as possible, in accordance with a directive from the Secretary of the Interior to the Bureau of Reclamation and the Fish and Wildlife Service early in January.

The balance will remain in wildlife refuges not subject to homesteading. Twenty-five hundred acres of the land to be homesteaded lie in California, near the town of Tule Lake. The remaining acreage is in Oregon just north of the State boundary.

There have been competing demands (a) for th opening of these public lands for homesteadin under Reclamation law, as the lands involved ar among the finest public lands for agricultural pur poses under irrigation in the West and (b) for re tention in public ownership since these lands ar considered by some conservation interests to b indispensable for the maintenance of the Pacifi Flyway, the area being one of the key waterfow concentration points on the North America Continent.

The Secretary's directive provides for mutua cooperation and further investigations for the de velopment of additional irrigated lands so tha waterfowl conservation areas and homesteadin opportunities can both be augmented.

By January 1, 1954, the Fish and Wildlif Service will take over the administration of land in the Tule Lake and Lower Klamath Refuge which are now administered by the Bureau o Reclamation and which are not to be opened fo homesteading. Leases of these lands are to be o a cash basis with careful attention to avoid lan monopoly or corporate farming.

The Bureau of Reclamation is to continue leas ing its lands in the area until December 3 1953. •

Atomic Energy Commission Releases Part o Wahluke Slope for Reclamation

Early in January 1953, the United State Atomic Energy Commission announced it woul release from restriction about 87,000 acres of lan on the Wahluke slope across the Columbia Rive from its Hanford production plants.

The Commission accompanied its announceme with a warning that its action does not mean tha all risk to life and property in the released land has been eliminated, and at the same time r affirmed its objection to farm settlement in th remainder of the area. For safety reasons, th Commission stated that no towns or cities shoul be established within 25 miles of the Hanfor reactor area.

The lands released from restriction by the Co mission comprise about 62,500 acres at the ea end of the slope, including 23,000 acres under th Potholes east canal which will enable the Burea of Reclamation to examine the irrigation servi possibilities from that canal. The newly releas area also includes approximately 24,500 acres e extreme west end of the slope. It is estimated at the Commission's action will permit the Buau of Reclamation to consider the irrigation of out 40,000 acres susceptible to crop producon. •

Admission Fee at Grand Coulee and Hungry Horse

Visitors taking guided tours through Grand ulee Dam in the State of Washington and ungry Horse Dam in Montana will be charged mall admission price in 1953 as a means of reying the Federal Government for the costs inrred. The price schedule will be the same as Hoover Dam which is: Adults, 25 cents plus cents Federal tax; military personnel (in unirm) 5 cents tax only; children under 12, free. lucational groups, such as high school classes d Boy Scouts will be admitted free when they me in a body, give advance notice of their proposed visit, and adjust the visit to the Bureau's convenience. •

More Columbia Basin Farms for Veterans

Friday, February 27, 1953, is the deadline for filing an application for one of the 11 family-size farm units near Quincy, Wash., on the million-acre Columbia Basin project.

Veterans of World War II will have priority in applying for the farms, located approximately 135 miles southwest of Spokane. The farms, varying in size from 55 to 143 irrigable acres, are priced from $1,238.70 to $2,122.

Applicants are required to have 2 years of full-time farming experience after 15 years of age and must possess at least $4,500 in assets to develop their unit. Veterans are not required to send in their discharge papers when they file their original applications with the Bureau of Reclamation office at Ephrata, Wash., where application blanks and additional information may be obtained. •

NOTES FOR CONTRACTORS

Contracts Awarded During December 1952

. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
S-3778	Palisades, Idaho	Dec. 22	One 150-ton traveling crane for Palisades power plant.	Moffett Engineering Co., Albany, Calif.	$85,385
S-3795	Missouri River Basin, S. Dak	Dec. 8	One 20,000/15,000/20,000-kva transformer for Rapia City suhstation, schedule 1.	American Elin Corp., New York, N. Y.	83,800
S-3795	do	do	One 115,000-volt circuit breaker for Rapid City substation, schedule 2.	Westinghouse Electric Corp., Denver, Colo.	23,950
C-3804	Yakima, Wash	Dec. 15	Furnishing and installing two 4,160-volt generators for Chandler power plant.	Electric Machinery Mfg. Co., Minneapolis, Minn.	284,093
S-3805	Yakima, Wash	do	Two 8,500-hp. and two 2,600-hp. vertical-shaft hydraulic turbines for Chanuler power and pumping plant, schedules 1 and 2.	James Leffel and Co., Springfield, Ohio.	412,46
S-3805	Yakima, Wash	Dec. 23	Two vertical-shaft centrifugal pumps for Chandler power and pumping plant, schedule 3.	Worthington Corp., Harrison, N. J	69,455
S-3810	Columhia Basin, Was	Dec. 24	Remote control and telemetering equipment for the hifurcation works and Adco watermaster's office.	Control Corp., Minneapolis, Minn	14,260
C-3816	Weher Basin, Utah	Dec. 10	Construction of Oateway tunnel	Utah Construction Co., Salt Lake City, Utah.	2,486,613
C-3819	Colo.-Big Thompson, Colo	Dec. 29	Installation of supervisory control and telemetering equipment at Oranhy and Willow Creek pumping plants and Willow Creek dam	David Rietveld, Fort Collins, Colo	13,880
C-3822	San Diego, Calif	Dec. 15	Construction of earthwork, pipe line, and structures for San Jacinto-San Vicente aqueduct.	S A. Healy Co., Chicago, Ill	6,798,101
S-3823	Central Valley, Calif	Dec. 17	Two switchgear assemhlies for Nimhus power plant.	I-T-E Circuit Breaker Co., Philadelphia, Pa.	32,700
C-3831	Missouri River Basin, S. Dak	Dec. 9	Construction of Missouri River crossing for Oahe-Midland 115-kv transmission line.	R. N. Campsey Construction Co., and C. F. Lytle Co., Denver, Colo.	115,615
C-3832	do	Dec. 23	Construction of 115-kv and 230-kv transmission line approaches into Fort Randall switchyard.	Hallett Construction Co. and Continental Co., Croshy, Minn.	168,095
C-3834	Cachuma, Calif	Dec. 18	Construction of Ortega and Carpinteria reservoirs and control stations.	Wonderly Construction Co., Long Beach, Calif.	939,003
S-3835	Palisades, Idaho	Dec. 22	Two 19.67-foot hy 28.03-foot fixed wheel gate frames for outlet and power tunnels at Palisades dam and power plant.	Valley Iron Works, Yakima, Wash	52,800
C-3836	Oila, Ariz	Dec. 17	Construction of earthwork, concrete lateral lining, and structures for Unit 3 of Mohawk distrihution system.	Peter Kiewit Sons' Co., Arcadia, Calif.	1,682,673
C-201A	Central Valley, Calif	Dec. 16	Recorder houses and measuring wells for Friant-Kern Canal.	A. C. King, Inc., Fresno, Calif	16,942
C-222	Cachuma, Calif	Dec. 9	Fencing Olen Anne reservoir site	Los Angeles Fencing Co., Inc., Los Angeles, Calif.	10,835
C-223	Central Valley, Calif	Dec. 4	Constructing and modifying turnouts, station L-648 to station 3715, Delta-Mendota Canal, schedule 1.	Stanley H. Koller Construction, Crockett, Calif.	85,285

NOTES FOR CONTRACTORS—Contracts Awarded During December 1952 (Continued)

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Co… am…
200C-223	do	do	Constructing and modifying turnouts, station L-648 to station 3715, Delta-Mendota Canal, schedule 2.	A. C. King, Inc., Fresno, Calif.	
300C-44	Parker Dam Power, Ariz.-Calif.	Dec. 1	Elementary school at Parker Dam Government Camp.	Pritchett Construction Co. Provo, Utah.	
500C-28	Middle Rio Grande, N. Mex.	Dec. 3	Buildings and utilities for maintenance headquarters at San Marcial.	The Barnes Co., Inc., Albuquerque, N. Mex.	
603C-26	Missouri River Basin, N. Dak.	Dec. 9	Clearing areas of Jamestown reservoir	Brasel and Whitehead, Riverton, Wyo.	

Construction and Materials for Which Bids Will Be Requested by April 1953

Project	Description of work or material
Boulder Canyon, Ariz.-Calif.-Nev.	Construction of 10 miles of concrete pipe laterals, 4 pumping plants of 59 to 8 cubic feet per second capacities, and 2 equalizing reservoirs to serve about 2,500 acres for part 2 of unit 8, Coachella distribution system, adjacent to the Coachella canal southwest of Indio, Calif.
Central Valley, Calif.	Construction cf laterals for the north section of Madera distribution system's unit 1 near Madera, Calif., comprises 32 miles of laterals varying in bottom width from 6 to 18 feet.
Do	Construction of 8 power turnouts of 2 to 9 cubic feet per second capacities, 3 gravity turnouts, and 20 laterals consisting of 10 miles of 12- to 30-inch diameter concrete pipe for Plainview Water district distribution system on the Delta-Mendota Canal about 2.5 miles southwest of Tracy, Calif.
Do	Unit 2 of Delano-Earlimart irrigation district distribution system on Friant-Kern Canal, located in Tulare and Kern Counties near Delano, Calif., is to include in construction 64 miles of 12- to 69-inch diameter reinforced concrete pipeline, monolithic concrete moss screens, the 170 cubic feet per second outdoor-type pumping plant D-3, and other smaller plants and highway and railroad crossings.
Colorado-Big Thompson, Colo.	Construction of 16.5 miles of 200 cubic feet per second Boulder Creek supply canal, an earth structure to convey water from the St. Vrain supply canal to Boulder Creek. Construction will include such structures as siphons, flumes, drops, bridges, and turnouts. Located between Lyons and Boulder, Colo.
Do	Construction of parshall flume and installation of staff guges on three dams in the Flatiron area, 5 miles west of Loveland, Colo.
Do	Installation of overhead ground wire on Greeley-Brush transmission line and alterations to overhead ground wire on Estes-Flatiron transmission line.
Columbia Basin, Wash.	Constructing a 1,600-foot earth dike, 5 to 16 feet high; erecting a pumping plant and installing two Government furnished pumping units; and furnishing and laying 1,100 feet of 18-inch high-pressure concrete pipeline for tho utilization of wastewater from Babcock pumping plant, W8 lateral system on West canal.
Do	Construction of 34-mile unlined reach of East Low canal, south from Warden, Wash., varying in capacity from 1,490 to 550 cubic feet per second and in base width from 22 to 20 feet. Major structures are 3 13-foot diameter monolithic siphons, 3 checks, 3 railroad bridges, wasteway turnout, 2 chutes and stilling pools, a monolithic railroad culvert, and 15 timber county road bridges. About 4,000,000 cubic yards of common excavation and 270,000 cubic yards of excavation are required.
Do	Construction of 60 miles of laterals of 12 to 2 cubic feet per second capacity, 6 miles of wasteways, and five outdoor type pumping plants for the P-9 Area on Potholes East canal. Located 10 miles north of Richland, Wash.
Do	Sealing of about 2 miles of unlined canal prism on Potholes East canal's third section will consist of excavating, replacing with select compacted material, and covering with a gravel blanket.
Do	Drilling test wells for groundwater observations in lateral Areas W-6A, E-4, W-8, P-3, and P-8.
Do	Fabricated galvanized structural steel (about 200,000 pounds) for bolted switchyard structures for 287-kilovolt autotransformer installation at right switchyard, Grand Coulee power plant.
Eden, Wyo.	Construction of Prospect diversion dam and canal, near Farson, Wyo., will include 225 feet of earth dike, a rock weir 4 feet high and 70 feet long, and 0.5 mile of 150 cubic feet per second Prospect canal.
Eden, Wyo.	Construction of Eden canal's 4-mile second sect… to include 1 mile each of 300 and 150 cubic fe… second capacity aad 2 miles of 260 cubic fe… second partially earth-lined canal, and a… tional 4 miles of 40 to 6 cubic feet per second laterals E-7, E-11, and E-12. About 250,000 … yards of excavation are required. Work is lo… about 44 miles northwest of Rock Springs, W…
Gila, Ariz.	Construction of 2.4 miles of 220 cubic feet per s… Dome canal and 2.6 miles of 100 cubic feet per s… lateral D-1.4E, near Dome, Ariz.
Do	Construction of 22 miles of unreinforced co… lined laterals and sublaterals of 45 to 15 cubi… per second capacities for Unit 4 of Mohaw… tribution system near Wellton, Ariz.
Kendrick, Wyo.	Construction of a ditchrider's nonmodern ho… mile south of Casper Canal and 4 miles e… Poison Spider Creek siphon; and repairing a … at Alcova Dam government community.
Do	Repairing and widening banks and placing … pacted earth lining on 0.4 mile of Casper Ca… Natrona County, Wyo., about 26 miles south… of Casper.
Missouri River Basin, Mont.	Crow Creek 100 cubic feet per second pumping … to be constructed about 4 miles southwest of … ton, Mont., on the Missouri River will lift … from the river an average of 176 feet throu… 1,180-foot-long, 52-inch inside diameter steel … discharge lino to Toston tunnel for gravity fl… Toston and Lombard Canals. The indoor … plant is to have a reinforced concrete substru… and a contractor-furnished superstructure 23 … feet in area and 25 feet high. The contract is … clude installing 3 Government-furnished 33.3 … feet per second pumps driven by 900-horsep… motors and an 8-ton single I-beam man… operated crane. Toston tunnel and a small … of canal at tunnel outlet are under constru… but construction of 7.5 miles of 100 to 35 cubi… per second Toston Canal and wasteway, 3 mi… 60 to 20 cubic feet per second Lombard Cana… wasteway, and lateral and drainage system… required in this contract.
Do	Three oil pressure, cabinet-type actuator gove… for regulating the speed of three 8,400-horsep… hydraulic turbines for Little Porcupine … plant.
Do	Three 32- by 20-foot radial gates for Tiber Dam.
Missouri River Basin, Nebr.-Kans.	Construction of 18 miles of unlined laterals … appurtenant reinforced concrete structures … Franklin canal's first section near Franklin, N… requires 90,000 cubic yards of excavation.
Do	Construction of 11 miles of unlined Naponee C… laterals, drains, and appurtenant reinforced … crete structures, requiring 200,000 cubic yar… canal, lateral, and drain excavation and … 8,000 feet of 18- to 28-inch diameter concrete p…
Missouri River Basin, N. Dak.	Raising about 0.5 mile of Buchanan Road and … facing with gravel and constructing a bridge … the James River, and raising and gravel sur… about 1 mile of the Edmunds Road, and r… present steel truss bridge over the James Riv… the Jamestown Reservoir area.
Do	Extension of the Garrison-Bismarck double-c… 230-kilovolt transmission line into the Gar… switchyard, and the Williston-Garrison … kilovolt transmission line into the Garrison sw… yard requires placing footings, erecting abo… Government-furnished steel towers, furni… materials and stringing aluminum conductors … steel overhead ground wires.

Construction and Material for Which Bids Will Be Requested by April 1953 (Continued)

Project	Description of work or material
i River Basin, k.	Construction of 20,000-kilovolt-ampere Rapid City substation near Rapid City, S. Dak., involves furnishing and erecting low voltage steel structures, erecting 115-kilovolt steel structures, and a 24- by 50-foot steel control building, and installing Government-furnished electrical equipment which includes one 20,000-kilovolt-ampere, 3-phase transformer; 115-, 25.2-, and 4.16-kilovolt bus structures, circuit breakers, and switching equipment; one 10,000-kilovolt-ampere synchronous condenser, and a 200-kilovolt-ampere distribution transformer.
	Construction of 66,667-kilovolt-ampere Sioux City substation near Sioux City, Iowa, involves furnishing and erecting steel structures and a 24- by 44-foot prefabricated steel control building, and installing Government-furnished electrical equipment which includes one 40,000/53,333/66,667-kilovolt-ampere, 110- to 69-kilovolt auto-transformer, and 230- and 69-kilovolt circuit breakers and disconnecting switches, and a 69-kilovolt voltage regulator.
	Second stage construction of the Brookings, Groton, and Summit substations will consist of placing concrete footings and installing Government-furnished power transformers and autotransformers.
	Second stage construction of the Armour, Beresford, Flandreau, Tyndall, and Woonsocket substations, in eastern South Dakota, will consist of furnishing and erecting structural steel bus structures and supports, installing Government-furnished control cable, power and autotransformers ranging in size from 5,000- to 20,000-kilowatt-amperes; 34.5-kilovolt interrupter switches; instrument transformers; additional sections of control boards in existing service buildings; and 12- and 34.5-kilovolt voltage regulators. Concrete footings will be required.
i River Basin,	Construction of fencing, bank protection, jetties, and revetment work for soil and moisture conservation on the Five Mile and Muddy Creeks, near Riverton, Wyo.
Palisades, Idaho	Relocation of 5.5 miles of State Highway 29 (U. S. 26) about 62 miles southeast of Idaho Falls, Idaho, from Big Elk Fill to Indian Creek near Palisades Reservoir. About 1,200,000 cubic yards of excavation are involved.
Paonia, Colo	Placing about 1 mile of concrete canal lining on scattered 250- to 1,400-foot long reaches on the 30-mile course of Fire Mountain canal. The canal is located on higher ground along Colorado Highway 135 running from Paonia to Hotchkiss, Colo.
Riverton, Wyo	Furnishing and placing asphalt membrane lining in selected reaches of the Wyoming Canal near Riverton, Wyo., between stations 1606 and 2560.
Shoshone, Wyo	Lining of approximately 7,000 feet of Lateral R-4-S having a capacity of 49.9 to 73.0 cubic feet per second Heart Mountain division. Estimated 23,000 square yards of asphalt membrane lining required.
Solano, Calif	Construction of 260,000-cubic-yard concrete arch Monticello Dam, about 295 feet high above foundation and 1,000 feet long at the crest, with glory-hole type spillway and penstock-type outlet works, located on Putah Creek, 39 miles west of Sacramento, Calif. The spillway will have a 72-foot diameter uncontrolled crest and a 28-foot diameter outlet tunnel. The outlet works will consist of two 90-inch penstocks through the dam with valve controls. Concrete will require 1,500,000 pounds of reinforcing steel. In addition, the contract is to include a 500-foot long concrete highway bridge and a 400-foot long timber bridge over Putah Creek and 2.5 miles of heavy highway construction. Bridge roadway widths are 26 feet for concrete and 24 feet for timber. The concrete bridge will have concrete abutments, nine piers, and nine 55-foot spans; the timber bridge will have timber bents and concrete footings.
Yakima, Wash	Construction of 6.6 miles of 435 cubic feet per second Chandler irrigation canal and 0.6 mile of 435 cubic feet per second wasteway for the canal's first section, near Prosser, Wash.

United States Department of the Interior, Douglas McKay, Secretary
BUREAU OF RECLAMATION OFFICES AS OF JANUARY 15, 1953

Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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March

1953

IN THIS ISSUE:

March 1953

Volume 39, No. 3

The Reclamation ERA

35 Years Ago In The Era

CROP ROTATION

Every farm should have a well-defined system of crop rotation. The object of crop rotation, if properly arranged, is two-fold. Each crop should leave the ground in better condition for the next crop than it was before, and each crop should prevent the propagation and development of plant pests. The fallacy that sugar beets injure the soil has not only been exploded but just the reverse has been found to be the fact. It is true that sugar beets take out of the soil the same elements that are removed by other crops, but in slightly different proportions. But, as has been stated, a large part of these mineral elements is in the top, which, if properly handled, will be returned to the soil in the form of manure, so that in the end but little plant food is removed from the soil by the beet crop.

(From an article on page 99 of the March 1918 issue of the RECLAMATION RECORD, predecessor to the RECLAMATION ERA.)

OUR FRONT COVER. PRIMING SIPHONS. Hersey B. Roberts of the Riverton project in Wyoming demonstrates one way of priming a siphon tube. The October 1949 and December 1951 issues of the RECLAMATION ERA described other methods. If you have any better ideas, send them in. *Photo by Thomas R. Broderick, Region 6 photographer.*

OUR BACK COVER is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners Kittredge and Coolidge.

DESIGN AND ILLUSTRATIONS by Graphics Section, Bureau of Reclamation, Washington, D. C.

R. F. Sadler, Editor

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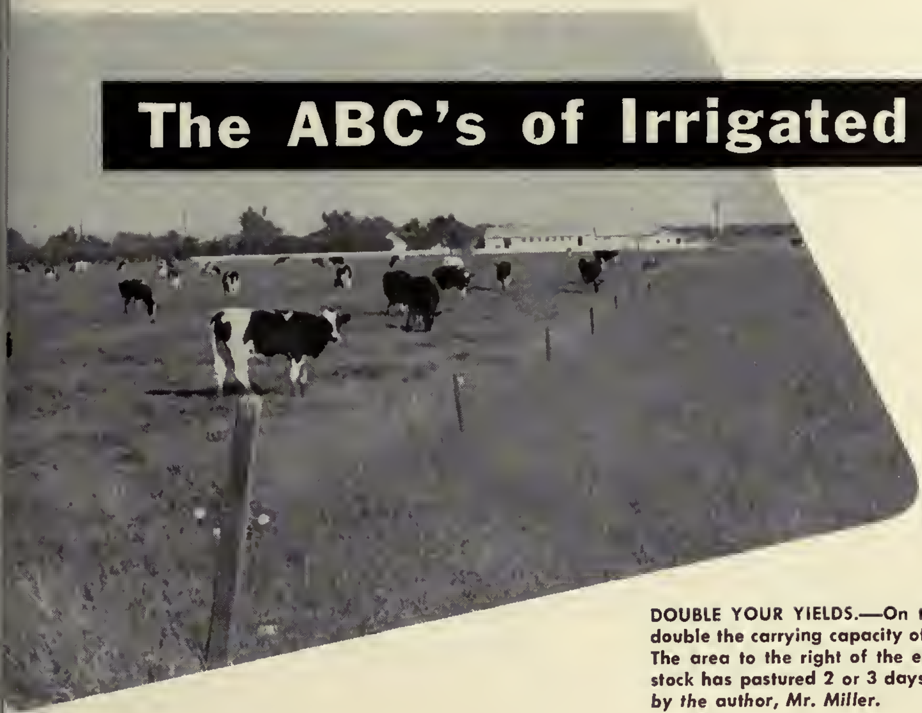
In this issue . . .

RECLAMATION PLACE NAMES IN THIS ISSUE

The ABC's of Irrigated Pastures



by MILTON D. MILLER
Farm Advisor,
University of California,
Glenn County, Calif.

DOUBLE YOUR YIELDS.—On the Orland project, Wackerman Bros. double the carrying capacity of their pastures by rotational grazing. The area to the right of the electric fence will be grazed after the stock has pastured 2 or 3 days in the field at left. ***Photo submitted by the author, Mr. Miller.***

THERE IS PROFIT IN IRRIGATED PASTURES.

Farmer after farmer in California is turning off 400 to 600 pounds of livestock gain per acre each year from irrigated legume-grass pasture land in which he has an investment of from $300 to $400. When beef and lamb on the hoof were selling for $25 to $30 per hundredweight, these irrigated pasture owners were netting from $65 to $125 per acre per year above their annual pasture production costs of about $35 per acre.

The volume of land planted to irrigated pasture in the State has doubled in the last 4 years and is now placed at over 600,000 acres. But it has taken over 25 years of experience to build up a requisite backlog of management know-how. Here are some of the newer ABC's of profitable pasture management which have developed from this experience.

GRAZING MANAGEMENT IS IMPORTANT. The advantages of rotational grazing are strikingly illustrated by the results secured by the Blaettler Bros. on their dairy in Santa Clara County. In 1948 they cross-fenced their 52-acre pasture into three subdivisions. Their 92 cows rotated from one subdivision to the other, grazing each section 10 days. That first year, feed replacement value of the irrigated pasture was found to be equal to 2.5 tons of alfalfa hay per acre. Although apparently practicing rotational grazing, their results were not up to expectations. They were not letting their pastures recover sufficiently between grazings. Under this 10-day grazing system, milk production began dropping about the third or fourth day, with an average loss of three cans of milk per day for the last 6 days in the grazing period.

In 1949, at the suggestion of the farm advisor, the 52 acres were divided into 30 paddocks. The herd, which had increased to 110 cows, grazed one paddock a day. Under this rotating schedule, any one paddock was rested 29 days between grazing. Feed replacement in 1949 was twice that of the previous year—5.5 tons of alfalfa hay per acre. Moreover, milk production was maintained at a continuously high level.

Dr. M. L. Peterson at the University of California Experiment Station, Davis, Calif., has been testing grazing methods. His trials prove that pasture forage yields can be increased by more than 60 percent by lengthening the period between grazings from 2 to 4 weeks. According to his tests, cattle do best if 3 to 4 weeks elapse between grazings of ladino clover-grass mixture. Four weeks' regrowth are necessary where alfalfa is the principal legume in the mixture.

Pasture fertilization pays off. On the Orland project of the Bureau of Reclamation, farmers are doubling and trebling forage yields by using nitrogen and phosphorous fertilizer applications. A late winter or early spring application of 500 pounds per acre of single superphosphate is now common. This is frequently followed by a March application of 200 pounds of ammonium sulphate and a similar application in August. Nitrogen fertilizer applications invariably step up grass production in all Glenn County irrigated pastures.

University of California tests on the Orland project show that the phosphorous content of pasture plants may be improved by applying phosphorous fertilizers to pastures. This opens up the possibility of improving the feeding value of pasture plants by fertilization.

Many dairymen have doubled pasture yields simply by saving and returning manure and barn washings to their irrigated pastures. Conserved in liquid manure pits, this source of increased fertility is pumped back onto the pastures through the irrigation system.

Water loving weeds seriously reduce pasture yields. Glenn County irrigated pasture owners mow their pastures at least twice each year; once in the spring and again in late summer. Many pasture owners mow a portion of each paddock ahead of each grazing period.

Each year, they also spray 2,4-D on about 20,000 acres of Glenn County ladino clover-grass pastures. This kills off dock, buckhorn, chicory, ragweed, yellow star thistle, and other weeds which reduce forage.

However, 2,4-D is fatal to trefoil and alfalfa, and must not be used on pastures where they are the principal legumes. Even on ladino clover, the spray must be properly timed, and the field kept well irrigated for 60 days following the application. Under Orland project conditions, the farmers spray in April. They apply 12 ounces of the acid equivalent of 2,4-D as an amine salt in 30 gallons of water to an acre, using a ground rig. This method, providing excellent control of most of the troublesome broadleaved pasture weeds in ladino-grass pastures, is popular and highly recommended for pasture weed control.

Irrigated pastures, a crop in the rotation system. Glenn County farmers are convinced crop rotation on irrigated pasture land helps to control weeds, improves the physical condition of the soil and permits the pasture operator to judiciously cash in on the build-up in soil fertility resulting from the pasture program.

Take the case of Farmcrest, the Wackerman Brothers' farm on the Orland project. Farmcrest is divided up into many 5-acre fields for rotational grazing. Every year a sixth of their oldest pasture land is plowed up in October and planted immediately to oats, or oats and vetch, for hay or silage. Early in June, the following year, they harvest about 3 tons of hay (or its equivalent) as silage. They then immediately plant another crop for silage—hybrid corn. The corn silage, at the rate of about 20 tons per acre, is harvested in late September or early October. The field is then promptly reseeded to irrigated pasture and left in for another 5 years. Coupled with other sound management practices, this system of crop rotation has doubled the stock-carrying capacity of their 60-acre ranch since they have owned it.

Managing meat animals on pasture. Irrigated pasture owners have known for some years that it pays to have dry roughage available for cattle and sheep on ladino clover pasture. For one important reason, it helps to control bloat. A mature animal, on an average, will eat about 1 ton of barley straw or similar low-grade roughage per head each season, in addition to the pasture.

Beef cattlemen of Salinas have been cooperating with the University of California Extension Service on a series of trials. In one large-scale field trial, gains from pasture, and supplements of 3 pounds of rolled barley and 4 pounds of grain hay per head per day, produced 640 pounds of gain per acre of pasture fed during the year. In another trial with an owner of beef cows and calves, 869 pounds of gain per acre of pasture per season were recorded when the pasturing stock was supplemented with barley and barley hay.

The newest development in pasture feeding is to use salt to regulate the intake of self-fed supplemental feed. Here is one mix which has given good results when self-fed to beef cattle on irrigated pastures:

200 lbs. salt
600 lbs. rolled barley
600 lbs. beet pulp
600 lbs. cotton seed meal

Although not widespread, the finishing of beef cattle on irrigated pasture is on the increase in California.

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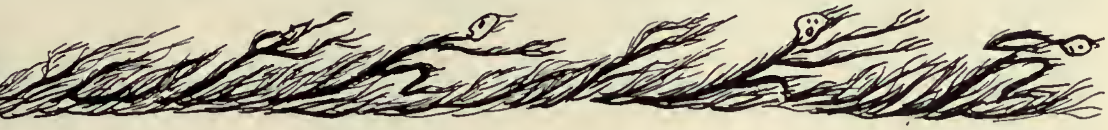
\ Well-kept Lateral Gathers No Moss



Part 1—How To Use Aromatic Solvents To Control Water Weeds in Irrigation Laterals

by JESSE M. HODGSON, Assistant Agronomist, Division of Weed Investigations, University of Idaho

TOR'S NOTE—The following article was prepared on the is of the cooperative investigations of the Division of ed Investigations, Bureau of Plant Industry, Soils and ricultural Engineering, Department of Agriculture, and iversity of Idaho, and was adapted from information tained in Idaho Extension Circular No. 123.

\ ROLLING STONE MAY GATHER NO MOSS—but en a swiftly flowing irrigation ditch may be-ne clogged with moss-like weeds.

Farmers who handle irrigation water to nurture eir crops, as well as managers and operators 10 handle water for entire distribution systems, ve long been plagued with this problem.

These submersed waterweeds increase their nui-nce value by making their greatest growth when ey can do the most damage. When field crops ed the most moisture, that is when under-water eeds slow the flow of water. That is when they ten choke up the water-handling facilities and use serious crop losses by interfering with water liveries. When farm machinery and workers e badly needed on other parts of the irrigated farm—that is when waterweeds are flourishing, and the irrigation farmer or manager has to stop farm work long enough to clean the water-delivery system.

New developments have gone far in solving this old problem for the irrigation farmer. Aromatic solvents taken from petroleum and coal tar and applied in the irrigation water kill the weeds in a short time and restore normal water flow. (The development of aromatic solvents by the Bureau of Plant Industry and Bureau of Reclamation was reported on page 81 of the May 1948 issue of the RECLAMATION ERA in the article entitled, "A New Killer for Water Weeds.") Dead weeds are no problem. They slowly disintegrate, and the water in the laterals gradually carries them away.

Tests in Idaho and other Western States show that the aromatic solvents are effective on sago

MOSSY MENACE, held by Author Hodgson at lower left. Below, waterweeds get a dose of weed control chemical in the Black Canyon Irrigation District lateral on the Boise project in Idaho. ***Both photos by Stan Rasmussen, Region I.***

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pondweed, leafy pondweed, and horned pondweed. In Idaho they call these weeds "horsetail moss." No matter what they are called, they have been nuisances in irrigation systems. But nowadays they all give way to aromatic solvents.

Treating waterweeds is not a complicated process. Any good sprayer with nozzles having 0.02 to 0.04 inch orifices will do the job. Common weed sprayers, livestock sprayers, or orchard sprayers are fine. Oil-resistant hoses should be used. Pressures of 40 pounds or more are satisfactory. Higher pressures of 100 to 150 pounds are better.

Place the nozzles of the sprayer under the surface of the water at the point in the ditch or lateral where treatment is to be started. Just above a weir is a good place. If you hold the nozzle under the water, the solvent and emulsifier will mix with the water. This forms an emulsion that contacts the weeds as the water flows down the channel. Putting the solvent into the water at the weir where the water is naturally agitated helps mix the emulsion into the entire stream. If you use high pressures in the sprayer and finer nozzle orifices, they will break the solvent into finer particles. Then you will be sure the chemicals are properly mixed with the flowing water and will contact the weeds.

How much of the aromatic solvent is required to kill the weeds in a particular ditch or lateral depends on the amount of water flowing and the distance to be treated. (See article entitled, "Short Cuts to Weed Killing Operations, Part 8—How to Apply Aromatic Solvents to Control Waterweeds" on page 18 of the January 1952 issue of the RECLAMATION ERA and the article entitled, "Slide Rule for Waterweed Control" by Mr. Hodgson, in the April 1950 issue.) For a ditch ¾ to 1¼ miles long, use 6 gallons of aromatic solvent for each cubic foot per second of flow. Tests show that this quantity will control the waterweeds for a ditch of this length. Put this amount of solvent into the water in a period of 20 to 30 minutes. Do not forget that 6 gallons are required for every cubic foot per second of water flowing. Thus, for a ditch carrying 6 cubic feet per second of water, 36 gallons of solvent would be needed. A flow of 10 cubic feet per second would require 60 gallons. But in all cases, the time for treatment remains the same. The solvent must go into the water for 20 to 30 minutes.

For a ditch 1¼ to 3 miles long, use 10 gallons of aromatic solvent for each cubic foot per second. According to tests, treatments at this rate sometimes extend much farther than 3 miles. Conditions of the water and weeds of each ditch will determine the exact distance that weeds will be controlled, and the point where a second (or "booster") application should be made.

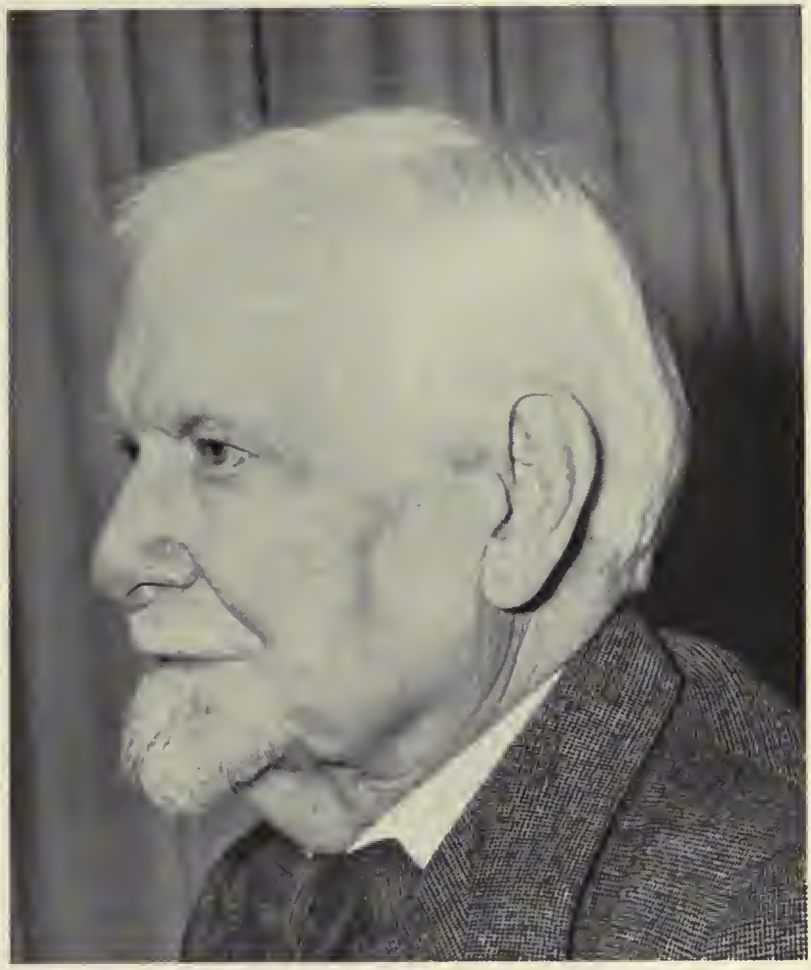
Before making the treatment, check your sprayer to see that it will deliver the desired amount of chemical. Nozzle manufacturers usually supply tabulated information regarding their product. If these tables are not available, you can determine a nozzle's delivery by catching the spray in a measure for 1 minute. The measured amount multiplied by the number of minutes for a treatment gives the delivery of that nozzle for the treatment period. For the check run, set your sprayer at the desired pressure and make the check with the chemical mixture you will use in the actual treatments. (For an easy-does-it method, see the article entitled. "Short Cuts to Weed-Killing Calculations—Part 9—Calibrating the Rig for Aromatic Solvent Applications," on page 32 of the February 1952 RECLAMATION ERA.)

Reducing the water flow before treating is often possible and advisable, but it is always essential to maintain enough water in the ditch so that the weeds are well supported and so that the emulsion will be well dispersed around them.

Knowing the amount of water flowing in the ditch *at the time of treatment* is positively essential if the control is to be successful. Too little solvent in the treatment not only results in poor weed-kill but wastes the material as well as the time and labor of the operator.

NEXT MONTH

MORE FACTS ON CONTROLLING WATERWEEDS



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lomination No. 16

WILLIAM R. WALLACE
Dean of Utah Reclamationists

WILLIAM R. WALLACE, considered for many ears the dean of Utah reclamationists, contantly reminds himself of Plato's admonition, The proud man is forsaken of God." He does ake pride, however, in his 20-year record (1923–3) as chairman of the Utah Water Storage Comnission. Half of the members of the commision were Republicans; half were Democrats. All water problems were worked out on a strictly nonpartisan basis, and every decision was by nanimous vote.

Of two other things is he proud. In 1948 the University of Utah bestowed upon him the honrary doctorate of jurisprudence, and in 1952 the Utah State Agricultural College at Logan, Utah, accorded him the honorary degree of doctor of engineering.

He has every right to be proud of his record for more than 40 years as an active proponent of water resource development and reclamation.

In 1910, former Utah Gov. William Spry asked Mr. Wallace (fondly called "Billy" by his associates) to do something to help develop Utah's water resources. He is known chiefly for that avocation, although he has other claims to fame. He was one of three Utahans who developed the first company to refine high octane aviation gasoline. The other founders of the Utah Oil Re-

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A DYNAMO AND DYNAMITE.—William R. Wallace pushes the plunger that touches off the first round of shots in opening the west portal of the Gateway Tunnel, formally starting construction on Utah's largest reclamation development, the $70,000,000 Weber Basin project on January 9, 1953. In the photo besides Mr. Wallace are (l. to r.) T. A. Clark, construction engineer, Bureau of Reclamation; Colonel H. H. Needham, commanding officer, Ogden Arsenal; three officials of the Weber Basin Water Conservancy District: LeRoy B. Smith, director; Harold G. Clark, director; and W. R. White, president, and George R. Putnam, vice president and district manager, Utah Construction Co., contractor for the tunnel job.

fining Co. in 1916 were John C. Howard and John F. Bennett.

Billy Wallace gave more than lip service and long hours of work to the cause of reclamation. He put up his own money to finance the initial investigations during the 1921–23 biennium which led to the permanent establishment of the Utah Water Users' Association in 1923, of which he was president for 5 years. According to T. W. Jensen, secretary of the Utah Water Users' Association, the 1923 Utah State Legislature appropriated $30,000 to reimburse Mr. Wallace for the expenditure.

As chairman of the Utah Water Storage Commission, Mr. Wallace was one of the most active backers of the Provo River project. He is personally credited with keeping the Federal program of investigations on the Deer Creek (Provo River) and other projects alive between 1929 and 1933. During this 4-year period, no Bureau of Reclamation funds were allocated for investigations in Utah. Billy Wallace offered his personal guaranty for the funds. With this evidence of good faith, the storage commission succeeded in obtaining State appropriations to cover the entire amounts necessary to continue the program.

Another valuable service was performed by Billy Wallace in 1937 and 1938 as a member of the three-man Repayment Commission. He and George T. Cochran, with Charles A. Lory as chairman, were appointed to "investigate repayment problems on Federal and Indian reclamation projects." Their findings influenced legislation incorporated in the 1939 Reclamation Act, including the so-called variable repayment plan.

Mr. Wallace was the leading exponent of legislation creating the Utah Water and Power Board, known as "Utah's Little Bureau of Reclamation for construction of small projects." He has been chairman of this organization since its inception in 1947. He has also been chairman of the Colorado River Commission, of the Utah State Planning Board, a director of the National Reclamation Association, and a member of the Utah State Drouth Relief Committee.

Although 87 years of age, he plans to visit Alaska's Eklutna project at his earliest convenience. He has already personally visited every Federal reclamation project in the 17 Western States. An inveterate traveler, he has managed to sandwich trips abroad in with his reclamation activities. He has sailed to the British Isles and uth Africa, and made several plane trips from ndon to points on the Continent—Lisbon, adrid, Rome, Milan, Vienna, Zurich, and unich.

Knowing that in many parts of Europe farm- are still harvesting with a sickle and treading e grain out on a threshing floor, Mr. Wallace serves: "In this country, with 60 million em- oyed, we are producing wealth at the rate of ,000 per person annually. This should permit ir young people to face the future without fear."

William R. Wallace was born December 10, 65, in what is now the heart of Salt Lake City's isiness district.

His parents, Henry and Ellen Hetherington arper Wallace, had come to Utah from England years before.

Mr. Wallace married Annie McCrystal in 1892, Salt Lake City. She bore five children, a ughter who died in childhood, and four sons now rominent in business and professions, John M., resident of the Walker Bank & Trust Co.; Henry ., manager of Utah Oil Refining Co.; Alexander ., Salt Lake City engineer and financier; and Villiam R. Jr., San Francisco, attorney. Mrs. Vallace died in 1939. There are four grand- hildren.

This is his own biography: "I was born on the orner now occupied by the Moxum Hotel and, s a boy, carried water to the elephants to get into he circus. After that I grew up." His career as proved that this early experience did not reate in him a permanent dislike for water.

In 1934, he was chosen "Salt Lake City's First Citizen of the year 1933." At the Salt Lake Ad- ertising Club's Award Banquet on March 14, 1934, the former Governor Henry Blood paid him he tribute which appears at upper right. Billy Wallace concluded his response to the Governor's ribute by describing a dream he had:

"I flew up and down the length of our great State, and in every town and village in this arid land, the contented citizens were planting their crops in peace and comfort. Harvest was assured, for back among the hills there had been impounded a plentiful water supply. That is my task. That is your task. We are accomplishing much and I have come to hope—almost to believe—that it will be my great privilege to see my dream come true."

Mr. Wallace has worked unceasingly to carry out Governor Spry's assignment and still looks forward, at the ripe age of 87, to future years of effort in the same cause. He views with great satisfaction the strides that are being made toward comprehensive development of the Upper Colorado River Basin. His hope for the future is that the Lower and Upper Basin States will be able to agree upon a plan of development from the river system's source to the ocean—a plan that will put every drop of water to beneficial use. ###

Salt Lake City's First Citizen

The following tribute was paid to William R. Wallace by former Governor of Utah Henry Blood on March 14, 1934:

The vision of this man has served and is protecting the people of our State. He saw the danger of aridity advancing to thwart the purposes of the pioneers of the State. Perhaps no man has studied more keenly and continuously the needs of the State of Utah and her people, nor has any felt more deeply and sympathetically the trials incident to conquering the semiarid region that is Utah and making it literally blossom as the rose.

A little while ago I learned for the first time that never in all his civic career had William R. Wallace received the slightest remuneration. I could not buy his ticket; I could not pay his hotel expenses. He was there in Washington as a citizen of Utah bearing his own expenses and assisting mightily in our work. I want to acknowledge here and now that the work of Mr. Wallace in connection with the securing of something like $14,000,000 of reclamation money was the turning point in our joint efforts of the moment, and the efforts of the Congressional Delegation.

Canyon Ferry Nearing Completion

With the award of the final major contract to complete construction of the Canyon Ferry Dam, Power Plant and Switchyard, on the main stem of the Missouri River, 17 miles from Helena, Mont., this key control structure for irrigation, flood control and hydro-power generation in the Canyon Ferry Unit, Helena-Great Falls Division of the Missouri River Basin project, should start producing power by the end of this year.

Eiseman, Seabrook, and Elliott, of Chula Vista, Calif., won the contract for the final stages of construction in the power plant on a low bid of $694,183.50, and started work in February. According to the contract, the first of the three 16,666 kilovolt-ampere generators is to go on the line by December 1953. The second is scheduled for production in 360 days, or late February 1954, and the third in 420 days—April 1954.

Canyon Ferry Dam will be 220 feet high, with reservoir storage space for 2,050,000 acre-feet of Missouri River waterflow and powerplant of 50,000 kilowatt generating capacity. #

Don't Gamble with water quality

by BRUCE F. BEACHER, Soil Scientist, Bureau of Reclamation, Washington, D. C.

MANY OF US REALIZE that our standards for water quality, like many other standards, are averages based upon experience or demand. Just as soils, crops, farm management and irrigation practices can be varied from place to place, so may the type of water which is good or bad vary from one locality or another. Underlying these things are the economic and social conditions which largely determine what we can or cannot do and the standards for success of any venture.

You might travel through Egypt or the Middle East and find date palms, garden vegetables and alfalfa being successfully irrigated with low quality water. The Egyptian, Iraqi, or Saudi-Arabian is faced with survival, and a successful crop is one which furnishes food and fiber for today's family needs alone.

The water user in this country is part of a quite different, highly competitive, economic and social system which demands his best efforts and the best use of resources available to him.

But water users everywhere have one problem in common—to maintain, if not improve, the productivity of the land from which our food and fiber must continue to come. With this in mind, what can be done if the experts say that your water supply is questionable or unsuitable for irrigation?

First, heed the warning and avoid using such water if at all possible. Remember that the water in the soil becomes as much as 10 to 100 times more salty than the irrigation water. You are gambling against odds that may be two to one or one hundred to one, depending upon your soil, type of crop and your irrigation skill.

If you must gamble, there are ways to reduce the odds. The most important thing is drainage. Sometimes low quality water can be used for a long time, if you have good surface and subsurface drainage to prevent building up the salt content of the soil. Some soils drain readily as the land has sufficient slope and natural outlet channels to allow the leaching waters to move off. Other lands need grading and leveling, tile drains, open drains, or pumping to keep percolating waters with their salt burden moving down and out of the root zone. If your land does not drain freely, find out if you must install drains. If you cannot afford the drains, then your standards for water quality and water use must be set very high, or your son, grandson, or great grandsons may inherit a salt flat.

The vast wastes of land in Iraq, once irrigated from the Tigris and Euphrates Rivers, which contained only a little salt, are mute evidence of poor drainage. And in this country thousands of idle acres of alkali land in Colorado's San Luis Valley and other places show what can happen in a relatively short time. Reclaiming such land is usually a very expensive, long-term job.

For a simple but effective rule, do not use water of questionable quality on land that can't be drained.

The Bureau of Reclamation has a special interest in drainage and strives to foresee and control such problems by land classification, drainage investigations, water studies and timely construction of outlet drains for you. But this is only part of the job. Proper use of water and installation of tile drains on the farms are often the key to effective drainage. It is up to the water user to see the job carried through successfully.

The manner in which water is used has much to do with the quality required for sustained irrigation. More water of low quality must be used so that salt from previous irrigations will be leached and adequate moisture will be present in the soil for the crops. The more salty the water, the more difficulty most plants have in absorbing it through their roots. As the soil becomes drier, the soil water becomes saltier. If the water is quite salty to begin with—and remember that most drain waters and ground waters are—the plants may wilt before the soil is dry. Seedlings are especially sensitive and it is important to supply enough water for their needs by more frequent irrigation. At the same time, avoid wasteful use of water causing seepage and erosion.

Salt Tolerance

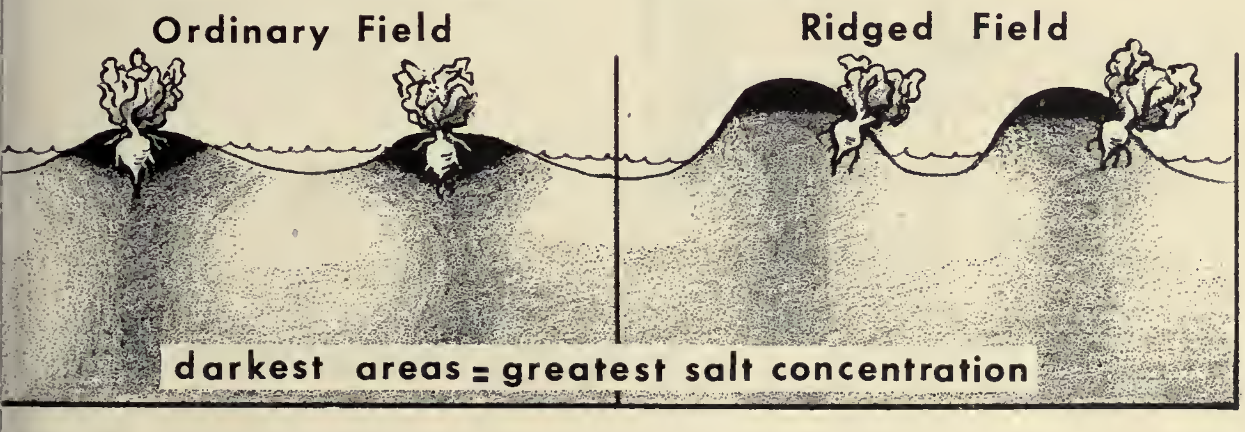
[RE]DUCE THE ODDS by planting the right crop for your soil and [w]ater quality.—Date palms, some grasses, garden and sugar [be]ets, and cotton have good salt tolerance. Cantaloupes and [to]matoes, sometimes asparagus, small fruits like figs, grapes and [oli]ves, alfalfa, some grasses, clovers and many truck crops, are moderately tolerant to salt conditions. White and sweet potatoes, artichokes, beans, citrus and tree fruits, some grasses, clovers and truck crops, are extremely sensitive to salt. Further information may be obtained from the United States Salinity Laboratory, Riverside, Calif. Drawing by Graphics Section, Washington, D. C.

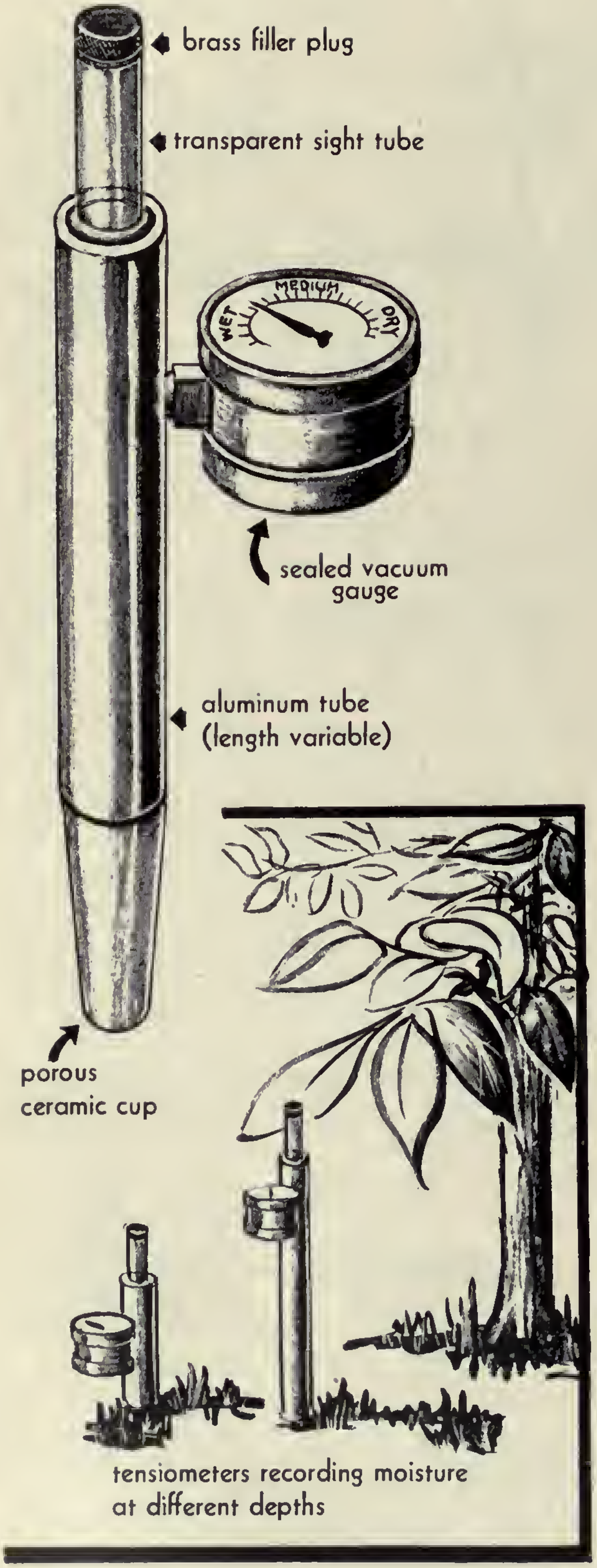
You can find good use for the new low-cost [m]oisture meters or tensiometers which take some [of] the guesswork out of irrigating and may save [yo]ur crop without wasteful use of water. In [ar]eas where rainfall and snowmelt are not enough [to] leach salts during off-season periods between [cr]ops and especially before planting, flooding [an]d leaching are necessary.

Certain crops and varieties and strains of crops [ar]e known to be relatively more salt tolerant than [ot]hers. The date palm, sugar beet, garden beet, [m]ilo, rape, kale, cotton, Bermuda grass, wild rye, [w]heat grass and several other grasses have proved [to] be quite tolerant. On the other hand, many fruit trees, clovers, potatoes, celery, green beans, egg plant and other truck crops are sensitive to salty water and saline soils. Although some plants become more resistant to salinity as they mature or develop resistance over longer periods of time, such as in the case of alfalfa, a wise choice of tolerant crops will prove best.

Another way of meeting the problem of salty water is ridging the soil for the seedbed. Salt accumulates on the side of the ridge above the level

HOW TO BY-PASS SALT BY RIDGING.—*Drawings by Graphic Section, Washington, D. C., based upon information published by the University of Arizona at Tucson, and the United States Salinity Laboratory, Riverside, Calif.*





of water in the furrows. The seed can be planted below this level and the plants will root down into soil which is less saline. A practice with beets is to throw up ridges over the seed to protect against rapid drying of the soil. Eradication of grasses and weeds which compete with crops for moisture is important. Mulching will also aid in control against rapid drying of the soil.

Finally the water itself may be diluted with better water or chemically treated. In many places the drain waters, gronnd waters, and return flow must be diluted ten times or more for safety in nse. Reservoir releases should be made when the stream flow becomes too low for effective dilution of return flow. Chemical treatment of water which contains a high percentage of sodium—the element linked with black alkali and poor drainage—is possible if the water has a low total salt content.

The ratio of calcium and magnesinm to sodium is important, and a few hundred pounds of gypsum or calcium sulfate added to an acre-foot of water may create a satisfactory ratio. But in many cases, a full ton of gypsum is necessary. The California Extension Service has devised a simple machine to add powdered gypsum to irrigation water by using a belt running under a hopper filled with gypsum. Newer methods of treating water are being studied. The Bureau of Reclamation is leading a search for practical electrochemical processes and other methods to improve present water supplies and to convert sea water to nsefnl irrigation supplies. But the search will take time and difficult technical problems must be solved to develop low-cost, large-scale methods.

Meanwhile, know the quality of the water you must nse and use it properly to conserve and perpetuate the productivity of the land for tomorrow's generations. Don't guess—have your water tested. If the report on your water is not good, perhaps there is some way to use it safely. Your county agent, State experiment station, extension service and Federal agencies are willing to assist you. But remember that the use of any questionable water for irrigation is a gamble with one of our most valuable heritages—and the odds may be one hundred to one against you. ###

HOW TO TAKE THE GUESSWORK OUT OF IRRIGATION *by using a moisture meter to tell you when ond how much to water.—Drowing by Graphics Section, Washington, D. C., bosed upon material from the Irrigotion Engineering Co., Riverside, Calif.*

An irrigated cotton field about 10 miles north of El Paso, Tex., on the Rio Grande project.
Photo by Dale A. Hovey, former Region 5 photographer.

THE MIRACLE OF THE RIO GRANDE

by WILLIS C. BOEGLI, Agricultural Economist
Operation and Maintenance Division
Amarillo, Tex., Region 5

From the cultivation of native corn with the stone hoe to provide food for a few Indian families to a modern miracle of irrigated crop production valued at over $45,000,000 a year, is the agricultural history of the Rio Grande irrigation project in southern New Mexico and southwestern Texas.

The total cost of the irrigation facilities was about $10,700,000. It is estimated that another $10,000,000 has been spent in the development of the project lands, and a similar amount in river rectification and channelization work, making a total cost of approximately $30,500,000 which could be directly or indirectly attributed to irrigation. This capital investment has created a crop value of over $533,000,000 in the past 38 years.

When the Spanish explorer Cabeza de Vaca and his colorful band of mounted adventurers wandered up the river in 1536, they found Indians cultivating corn along the Rio Grande near the present site of the city of El Paso. Other explorers followed, and in 1598 Padre Garcia de San Francisco Y Zuniga established a Mission across the Rio Grande and began schooling the Indians in more advanced methods of growing crops.

During the years of the exploration and Mexican colonization of the Rio Grande Valley to and beyond Santa Fe, the pueblos near El Paso

flourished as a stopping place for the travelers as they moved from the eastern shores of old Mexico north into this new land. In 1682 an Indian brave of the Tehua tribe named Pope led a revolt which drove the white invaders and the Christianized Indians from New Mexico into the El Paso area. The serious need for food resulted in the establishment of several pueblos south of El Paso where the waters of the Rio Grande were used to irrigate the lands.

In 1805, the Mexican Government gave Don Juan Garcia a land grant near the present site of Las Cruces, N. Mex., which was the original settlement from which the agriculture of the New Mexico portion of the project developed. With the western movement of the American pioneers during the period 1840–60, the irrigation development grew rapidly and it is estimated that 40,000 acres were irrigated by various diversions from the Rio Grande.

Irrigation from the Rio Grande above this area, both in New Mexico and Colorado, reduced the summer flow of the river, causing severe shortages of water for irrigation not only on the American side of the river but also for the Mexico developments south of the Rio Grande. As a result of a petition of the Mexican Government, a treaty was concluded in 1906 with the United States dividing the waters of the Rio Grande between the two nations and providing for a storage reservoir which would prevent the severe water shortages.

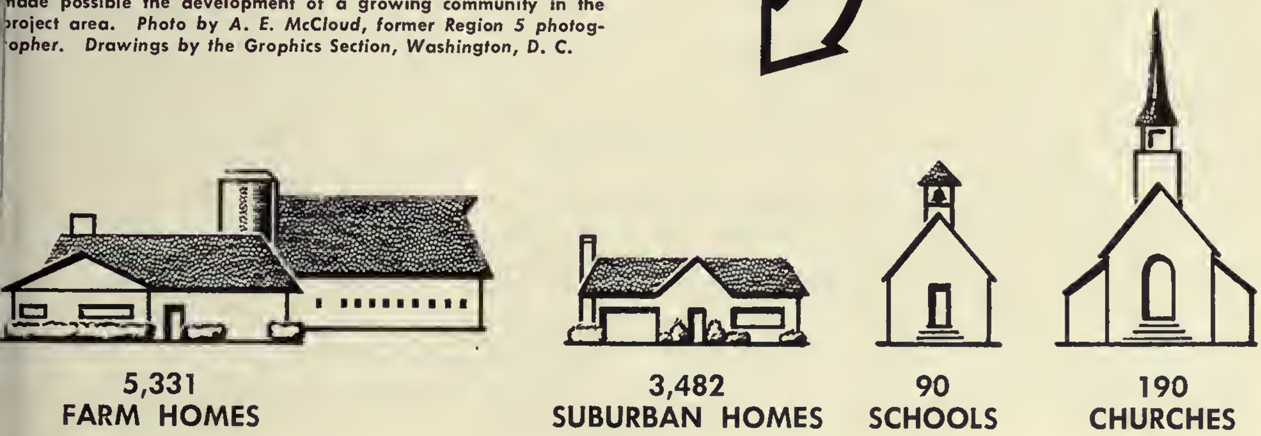
In 1906, before New Mexico was a State, the Reclamation Service filed intentions to appropriate waters from the Rio Grande for the proposed reservoir. Construction of the Elephant Butte Dam began in 1911 and the first water was stored in 1915. Since that time a hydroelectric plant has been installed at the dam and many changes have been made in the irrigation distribution system, including new diversions from the river and construction of a drainage system.

The human struggle from the days of the Indian with his stone hoe to the present time has created

a modern miracle of food and fiber production. During the period 1914–51 inclusive, the project has produced over 3,000,000 bales of cotton, over 1,000,000 tons of cotton seed, and 4,500,000 tons of alfalfa hay, in addition to thousands of tons of vegetables, grains and other crops. Converting this production into carloads and the cars to trains, this production would require a continuous freight train from El Paso, Tex., to New York City; El Paso to San Francisco, and El Paso to Chicago. In 1951 alone the project produced the equivalent of 2,879 cars of cotton lint; 3,131 cars of cotton seed, and 2,131 cars of alfalfa hay, or about 81 trainloads of crops produced.

The value of crops produced during the period 1914 to 1951 inclusive, was over $533,000,000 while the value of crops produced in 1951 was $45,842,000. In addition to the vast quantity of food and fiber that are ultimately manufactured from the project production, it has made homes for 5,331 farm families, suburban homesites for an additional 3,482 families. Ninety schools and

FROM PRIMITIVE BEGINNINGS, irrigation in the Rio Grande Valley has become a multi-million-dollar asset to the Nation. Above, a typical scene of modern farming methods—alfalfa baling operations on H. E. Elmendorf's property, 4 miles south of Las Cruces, N. Mex. At right, an artist's conception of the continuous freight train which would be required for crops produced on the Rio Grande project from 1914 through 1951. The irrigated crops have made possible the development of a growing community in the project area. *Photo by A. E. McCloud, former Region 5 photographer. Drawings by the Grophics Section, Washington, D. C.*



190 churches are scattered over the project area attesting to the social and religious development of the people.

Irrigation has been the magic that changed the Rio Grande desert with a few Indian farmers to one of the greatest food and fiber producing areas of the Nation. Man's ingenuity, determination and skill has achieved much since the days of the Indian with the stone hoe. ###

University of Colorado Aids World Water Resource Development With Special Reclamation Study Course

Successful American business methods and management techniques are for the first time being made available to aid water resources development in foreign lands under a special course of instruction at Denver, Colo., jointly sponsored by the University of Colorado School of Political Science and the Bureau of Reclamation.

Student engineers from Thailand, India, Australia, Mexico, Brazil, Formosa, Turkey, Nepal, Colombia, Israel, and Chile were included in the first class of 25 which began a 16-week study of American management techniques in January at the Reclamation Engineering Center under the guidance of Dr. Leo C. Reithmayer, chairman of the graduate curriculum in Public Administration of the University of Colorado.

The new course of instruction was installed primarily to meet the continuous requests of foreign governments for "know how" in meeting management prolems encountered in the administration of their own water resources development programs.

None of the expenditures are met from the Bureau's domestic water resource development program. Expenses are met by funds furnished under the Point IV program of the Department of State, the Mutual Security Agency, or by the foreign governments themselves. #

Cachuma Dam Now Controlling Santa Ynez River

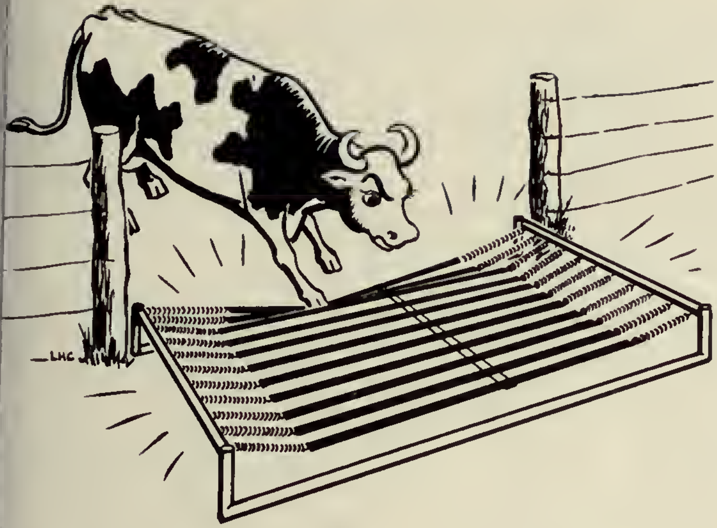
Last month the widely fluctuating and erratic flows of the Santa Ynez River in Santa Barbara County, Calif., were brought under control by the virtually completed Cachuma Dam. Winter runoff was being stored in the reservoir, and the outlet valves in the dam, through which water can be released downstream, were installed.

By the first of February, water in Cachuma Reservoir was more than 30 feet deep at the dam, or several feet above the dead storage level. Regional Director Richard L. Boke announced that Bureau forces would continue to store water, subject to the 1949 contract with the Santa Ynez River Water Conservation District and commitments to the Army for Camp Cooke. Deliveries could not be made through the 6-mile Tecolote tunnel, as the contractor had more than 6,000 feet to go. Completion of the tunnel is more than a year away.

Santa Barbara is the town where water was so scarce people could not sprinkle their lawns or wash their cars. When exceptionally heavy inflows of water were encountered in the outlet leg of the tunnel in August 1951, measures were immediately taken to tap this unexpected source of water. The flows, which carried loose material into the tunnel, were under control by November 1952. While awaiting completion of Tecolote tunnel, the people of the City of Santa Barbara and vicinity are getting the benefit of water seeping into the tunnel.

Mittry Constructors of Los Angeles, contractors for Cachuma Dam, expect to complete their contract by April of this year. Construction work is moving along on the other features of the $36,000,000 project which will provide domestic and irrigation water for Santa Barbara and its coastal plain.

The Goleta section is almost completed, with the South Coast Conduit, completed in July 1951, now in partial use. The Lauro Regulating Reservoir was completed in October 1952. Work on the Lauro Control Station, delayed by scarcity of materials, did not get under way until December 1952 but should be completed early this year. The only work remaining to be done on the Glen Anne Regulating Reservoir is protection of the upstream and downstream faces of the embankment. Work on the first unit of the Goleta distribution system should be under way by next month. #



"BEDSPRING" CATTLEGUARD

by
THEODORE NELSON, Chief
Irrigation Operations Branch
Region 1, Headquarters, Boise, Idaho

Walter White manages the Vale, Oregon and Warm Springs Irrigation Districts in Malheur County, Oreg., and puts in long hours on the job. But when irrigation farmers drove by his small pasture a year ago, they wondered whether it was really necessary for him to move his bed onto the ditchbank.

Actually, they were seeing a new type cattleguard. Walt had placed it in the fence line where his driveway left the oil-topped highway, and followed a small lateral to his home. The guard looks like a bedspring, but is narrower and has no undercoils. It is Manager White's idea of an economical and effective cattleguard that water users can build in their own shops during the slack winter months.

Such a device is a time, money, and water saver. Ditchriders will not have to stop and open gates when they are trying to outrun a canal break. They can save the time spent in stopping, opening, and closing a gate every day of the week at every fence line when they have a definite water delivery schedule to meet, weeds to pull, or cattails to cut

SHINY AND SPRINGY enough to discourage cattle; strong enough to permit vehicles to cross. ***Photo by Don Applegote, Region 1.***

out of Bill Jones' weir pool. White knew all this. He has spent much of his time on ditchbanks inspecting structures, outlining work programs, and meeting water users in the field, giving them a first-hand solution or advice on their irrigation problems.

As a good manager, he realized that the water users paid the bill for delays caused by opening and closing gates, and that something ought to be done about it. Yet, could they afford a pit concrete and steel cattleguard, costing from $250 to $400 at each fence? What they needed was a cattleguard that could be constructed at a reasonable cost. White felt sure that the farmers would cooperate and install their own cattleguards if costs were low, particularly if they could be built at home without too much difficulty.

With this in mind he made a frame of 1¼-inches pipe, 50 inches wide by 120 inches long. Initially the side members of the frame were 11½ inches long, but 9 inches on each end were turned up at right angles. A 48-inch piece of the same sized pipe was welded between the tops of the upturned ends. To the crosspieces on each end were welded eleven small rings evenly spaced, and into each ring was hooked a spring one inch in diameter, and 12 inches long. From each spring was suspended a strip of 1½ by ¼-inch strap iron with sufficient tension to carry the strap iron approximately 6 inches above ground in a floating position. To hold the eleven strips in a uniform position and to reduce rebound when a vehicle passed over the guard, a crosspiece of strap iron was welded midway from the ends, creating a floating grill in suspension from this light pipe frame.

After a season's trial in the entrance to his own pasture, White felt this floating grill cattleguard performed very well. There was no evidence of cattle ever having attempted to step into or jump across it. No doubt the bright coat of aluminum paint helped turn the animals away.

At the close of the pasturing season he brought the cattleguard into the project garage and parked the back wheels of a truck on the grill most of last winter to test the life of the springs. They showed no apparent loss of elasticity from this extremely long period in a stretched position.

Many water users in eastern Oregon are building their own cattleguards, and the Vale Oregon and Warm Springs Irrigation Districts foresee the time when their ditch operators will no longer be plagued with the time-consuming job of opening and closing gates on canal and lateral rights-of-way.

Irrigation Districts and farmers elsewhere may find that Manager White has presented the answer to a troublesome and costly problem. Modification may be desirable to meet specific needs but the over-all plan merits consideration and trial. ###

First Contract Let for Webster Dam

Foundation excavation work for Webster Dam on the south fork of the Solomon River near the village of Webster, Rooks County, north central Kansas, is now under way under the terms of a Bureau of Reclamation contract awarded in November 1952 to the H. N. Rodgers and Sons Co., Memphis, Tenn., on a low bid of $993,870.

The contract, first to be awarded on the Webster Unit, Solomon Division of the Missouri River Basin project, calls for the excavation of more than 1¾ million cubic yards of earth, the placement of more than 1¼ million cubic yards of earth, sand and gravel fill, and diversion of the river during construction. The job must be completed by January 1954 (or in 380 days).

The 2-mile long, 108-foot high Webster Dam to be constructed under additional contracts yet to be awarded, will, when completed, serve as one of the three key water control structures designed to check the recurring disastrous floods on the Solomon River and at Kansas City and other points in the Kansas River Basin.

The rolled earth-fill dam in the Webster Unit, besides providing storage space for 270,000 acre-feet of flood water, will facilitate the ultimate irrigation of 9,000 acres of land in the Solomon River Valley, as well as furnish important recreational and fish and wildlife protection benefits in the region.

The Bureau of Reclamation is doing everything possible to help the people of Webster, Kans., whose property has been acquired for construction of the dam. Early in the year, the Bureau granted an extension of time from March 15 to May 15, 1953, for relinquishing possession of this property so the children could complete their school year in the existing buildings. Some of the buildings and homes will be moved to new sites. Other families will abandon their buildings and receive salvage value compensation from the Bureau. #

CE PRESIDENT ROLAND EARHART of the Willwood Irrigation Dis- ct, Shoshone project, Wyoming, takes the floor during the 5th nual meeting of water users and Reclamation officials in Region Bureau officials seated at the table (l. to r.) are Regional Director K. F. Vernon and assistant Regional Director W. E. Rawlings, both of Billings, Mont., and E. D. Eaton of Washington, D. C., Director, Operation and Maintenance Division. More than 60 farmers from 11 projects in the Region 6 area attended the meeting.

WATER USERS HAVE THE FLOOR

At the fifth annual meeting of the stock- olders in Region 6, the irrigation water users minated the discussions. More than 60 farmers presenting 17,000 irrigation water users on 11 rojects served by Reclamation-constructed works Montana, North Dakota, South Dakota, and Wyoming (the Region 6 area) were on hand to ad the discussions and air their problems during two-day meeting with Bureau of Reclamation fficials and specialists at Billings, Mont., Janu- ry 8 and 9, 1953.

The projects represented included the Belle ourche in South Dakota, Buford-Trenton in orth Dakota, Lower Yellowstone in Montana and North Dakota, Intake, Buffalo Rapids, First and Second Divisions, Huntley, Milk River, and Sun River in Montana, and the Riverton and Shoshone n Wyoming. Representatives were also on hand rom two units of the Missouri River Basin proj- ct; the Savage Unit in Montana which went into peration in 1950, and the Angostura Unit in South Dakota on which some lands were served with water for the 1952 crop season. Work is now progressing to make possible the irrigation of he entire 12,000-acre Angostura Unit in 1953.

This 1953 program was specifically designed to bring about active participation of individual water users in the deliberations of the conference. Water users led discussions, including reports of project operations in 1952, drainage problems, canal lining and its results, effective weed-control program, crop census reports, and the effectiveness of water-user management on project operations.

In contrast to previous meetings which dealt with ironing out local administrative difficulties and technical aspects of project operations, a large part of this year's program was devoted to the needs for new or amendatory legislation, particularly as it relates to multiple purpose uses of the presently operating projects, retention of a percentage of the mineral rights on lands of affected irrigation districts, and the use and management of Reclamation withdrawn or acquired lands.

One of the highlights of the meeting was the presentation of a report by the Huntley Project Future Farmers of America Chapter relative to on-farm water use studies conducted on their farms in 1952. The report was given by F. F. A.

(Please turn to page 67)

PROTECTION FOR PLYWOOD

by M. R. SPINDLER, Engineer,
Design and Construction Division
Denver, Colo.

HERE'S GOOD NEWS for the water user who has trouble keeping his plywood buildings looking spic and span. Engineers and technicians in the Bureau of Reclamation laboratories in Denver, Colo., have found a way to cut down on that troublesome—and expensive—problem of checking and layer-separation which occurs when paint applied on plywood cracks or buckles.

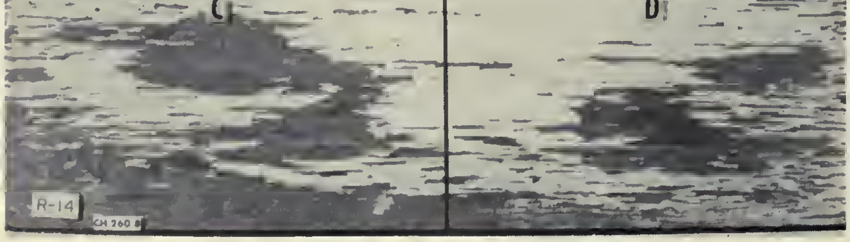
Eighteen months ago the paint specialists in the laboratories got an appeal for help from one of the Bureau's construction camps. Ordinary paint jobs were not providing adequate protection for prefabricated plywood structures in use there.

The engineers tackled the problem of surface protection for plywood by testing eight different measures which appeared to have promise. They marked off a 4- by 8-foot sheet of ordinary plywood into 32 1-foot squares. Each of the eight coatings was applied to four different squares to compensate for local differences in the wood. The test board was exposed to the ravages of wind, sun, rain, snow, freezing, and thawing atop the laboratory building at the Denver Federal Center. For a year and a half the panel remained on the roof.

When it was taken in for final examination, one of the coatings was still in excellent condition. The two second-best each appear to have given equal results.

The best protection was gained by first applying a coat of top-quality outside white house paint, thinned with 1 pint of raw linseed oil per gallon of paint. Two coats of unthinned outside white were applied after the primer was dry.

Two of the tested coatings gave second-best performance. On one of these, the primer was a standard outside house paint. The other primer was a low-viscosity varnish, fortified with a fungicide to forestall mold damage. In each instance, the primer was topped with two coats of high-quality outside white.



AFTER 26 MONTHS OF WEATHERING (fol-lowing 3 months of weathering before the four coatings were applied) this shee[t] of plywood demonstrated the qualities o[f] (A) an undercoater for outside house paint reduced with spar varnish—four parts o[f] undercoater to one part of varnish, (B) spar varnish, (C) shellac, and (D) commer-cial knot sealer. *Photo by W. M. Batt[...]* Denver, Colo.

What to do about your plywood surfaces which e already checking? The paint laboratory peo- e believe they have an answer to this problem, o. They have tested two maintenance coatings, ste wood filler and white lead-in-oil paste. So r, the white lead-in-oil paste has effectively aled the checks and provided a sound, smooth se to which paint may be applied. The paste- od filler does not seem to be flexible enough d shows no advantages for this use. Paint alone ill not prevent further checking because the int film will not bridge the checks to provide continuous coating.

All materials used in the tests conform to Fed- al specifications, and were applied according methods described in the PAINT MANUAL, a ureau publication used as a guide to the selection d application of coatings for wood, metal, and her surfaces. Where paints conforming to the ederal specifications are not available, a second- est choice is to use only that furnished by an stablished, reliable paint company.

If you are interested in learning more about ethods of using paint for protection, you can et the PAINT MANUAL for $1.25, either by writing to the Superintendent of Documents, Washington 25, D. C., or the Bureau of Reclamation, Supply Field Division, attention 841, Building 53, Denver Federal Center, Denver 2, Colo. ###

Water Users Have the Floor

(Continued from page 65)

embers Edward Reiter and John Reed who udied irrigation efficiencies by measuring irriga- on water delivered to the farm, and runoff water aving the farm during the 1952 crop season.

The irrigation farmers passed two resolutions. ne proposed that land withdrawn or acquired for eclamation purposes that is not a part of the arm units should be retained under withdrawal y the Bureau for the benefit of the water users. he second resolution supported legislation which ould provide a more equitable division of min- ral rights on the Reclamation farms.

Water users were brought up to date on the rospects of an adequate water supply for 1953 y a report, entitled, "Value of Snow Survey to the rrigation District," given by A. R. Codd of ozeman, Mont., hydraulic engineer for the Soil onservation Service. Stanley Howard, also of ozeman, an irrigation specialist for. Montana tate College, gave a review of methods for ef- icent use of water on the farm. Highlighting the two luncheon meetings were talks by H. L. Buck of Billings, treasurer and Montana director for the National Reclamation Association, and Tom Barnes of Billings, a geologist for the Shell Oil Company. # # #

Kirwin Dam To Be Completed in 1955

During the latter part of January, the Texas Construction Company, Dallas, Tex., was awarded the contract, on a low bid of $6,729,670.80, to complete construction of Kirwin Dam in Phillips County, Kans., by December 1955. (See article entitled, "Kirwin at the Crossroads" in the August 1952 issue of the RECLAMATION ERA.)

The construction contract award stipulated that work on completion of the dam must be begun within 30 days, and completed in 1,050 days.

The Texas Construction Company's proposal was the lowest among 15 bids submitted for the work. The competition for the contract, with prices ranging upwards to 12 million dollars, resulted in an unusually advantageous deal for the Government. #

Record-Making Repayment Contract Sparks Weber Basin Project

SIGNING THE WEBER BASIN REPAYMENT CONTRACT.—From l. to r., W. Rulon White, president, Weber Basin Water Conservancy District; Assistant Commissioner of Reclamation Harvey F. McPhail (witnessing the signatures); E. O. Larson, Region 4 Director, and E. J. Fjeldsted, manager, Weber Basin Water Conservancy District.

Reclamation's largest single repayment contract was executed December 12, 1952, in Ogden, Utah, when the president of the Weber Basin Water Conservancy District, W. R. White, and Regional Director E. O. Larson of the Bureau of Reclamation, acting under delegation of authority from the Secretary of the Interior, signed a $57,694,000 contract for repayment of the reimbursable costs of the multiple-purpose Weber Basin project, Utah.

Qualified voters of the district, comprising four counties in northern Utah, had previously authorized the District to enter into the contract. In the December 6, 1952, special election, the ratio of voting was 5 to 1 in favor of undertaking the huge obligation. The repayment period is 60 years.

Four days after the election, authorizing execution of the repayment contract, a $2,486,613 construction contract was awarded by the Chief Engineer to Utah Construction Company for construction of 3.3-mile Gateway Tunnel. The tunnel is the first unit of construction under the Weber Basin project which is the largest reclamation project in Utah history and the largest of the 10 reclamation projects authorized by the 82d Congress on July 9, 1952.

Before the Weber Basin project repayment contract was signed, the $42,000,000 repayment contract for the Wellton-Mohawk Division of the Gila project in southwestern Arizona enjoyed the honor of being Reclamation's largest single repayment pact.

The Weber Basin project will irrigate 50,000 acres of new lands, plus 24,000 acres now receiving an inadequate water supply, and supply municipal water to more than 20 communities and 3 permanent military bases between Salt Lake City and Ogden. The $70,000,000 project will provide 40,000 acre feet of new water each year for municipal, industrial, and military use, eliminate serious flood problems, reclaim waterlogged land, generate hydroelectric energy for irrigation pumping, improve fish and wildlife conditions, and provide recreational benefits.

Construction was officially started on January 9, 1953. (See photos on page 54 of this issue.) #

Ohio and Minnesota Firms Win Contract for Yakima Generators and Turbines

As the initial step in constructing the Kennewick Division of the Yakima project in the State of Washington, contracts were awarded in December to the James Leffel Company of Springfield, Ohio, and the Electric Machinery Manufacturing Company of Minneapolis, Minn., for the manufacture and installation of hydroelectric generators and the manufacture of hydraulic turbines for the new Chandler Power and Pumping Plant near Prosser, Wash. This is the eighth of the ten Reclamation projects to get under way since July 1, 1952, on which construction was authorized by the 82d Congress.

Under the Bureau of Reclamation contracts, the Minneapolis firm won the award for the two 6,000-kilowatt generators, on a low bid of $284,093. The Ohio firm won their contract on low bids of $284,977 for the two 8,500-horsepower turbines to be connected with the electric generators, and $127,490 for the two 2,600-horsepower turbines to be connected with hydraulic pumps in the Chandler plant.

Both contracts stipulate that the time of delivery is important and require that the pump turbines be shipped by August 1954 (610 days), the turbines for the generators two months later (October 1954, or 670 days from the date of the award) and the two generators by February 1955 (in 780 days). According to the schedule the first genrator is to be completely installed by June 1955 nd the second generator 2 months later, or by ugust 1955.

A contract for performing all work for the construction of earthwork, concrete lining and structures on the Chandler Canal also has been awarded J. A. Terteling & Sons, Boise, Idaho, on a low id of $1,613,278.60. Under the award the canal onstruction work would be completed in 750 ays, or by February 1955.

Construction contracts were awarded as soon as ossible after voters of the Kennewick Irrigation District held a special election on December 30, 952, and voted to ratify a contract to reimburse e Federal Government for that part of the roject costs to be repayed by irrigation. As required by special Federal legislation authorizing e project, the Federal Government will receive 12,516,300 in construction costs from power and rrigation revenues, of which the water users, nder the proposed contract, would repay 4,809,700 over a 66-year period, including a 10-ear development period for new lands. Total st of the project is estimated at $13,520,800, hich includes an allocation of $588,700 of the cost f existing storage reservoirs for the Yakima roject. Of this amount, $1,041,400 was allocated fish and wildlife benefits from the project, and not to be repaid from irrigation and power evenues.

During the 6-month irrigation season the power anal will be used primarily for irrigation, lthough at least half the canal capacity will be vailable for power. During the 6 winter months, hen the canal is not used for irrigation, the entire anal capacity and divertible flow will be available for power production. For this reason, it as been concluded that 30 percent of the joint roject maintenance costs for the Prosser Dam nd the Prosser-Chandler Power Canal shall be llocated to irrigation and 70 percent to power.

Development of the Kennewick Division was uthorized because of the loss of about 7,000 acres f irrigated farm land from the Richland Irrigation District where the city of Richland now is ocated. This is the administrative, business, and ousing headquarters for one of the Atomic Energy Commission's plants located at Hanford. This plant was constructed during World War I, is now in full operation, and has continuously arried on a vigorous construction program. This oss of 7,000 acres, together with the encroachment of urban population upon irrigated farm lands adjoining the city of Kennewick, has resulted in at least a 50 percent reduction in the supply of agricultural products available for processing in local plants. In addition, McNary Dam, now under construction by the Corps of Engineers and located on the Columbia River 29 miles downstream from Kennewick, is scheduled for completion in 1953. The backwaters from this dam will inundate another 1,533 acres of croplands now irrigated southeast of Kennewick.

Establishment of the Hanford Atomic Energy Works has added approximately 50,000 people in the Tri-City communities of Richland, Kennewick, and Pasco, thereby creating an excellent local market for agricultural products.

The Kennewick Division will provide around 425 new farm opportunities for veterans and other interested parties. The power system will furnish required power for irrigation pumping, and during the non-irrigation season and off-peak irrigation months, substantial quantities of surplus power will be available for commercial distribution.

The plan for immediate development of the Kennewick Division involves the construction of an irrigation system to serve a gross area of 18,871 acres, a hydraulic pumping plant to lift water into the main canal of the irrigation system, and a hydroelectric power plant with 12,000 kilowatts installed capacity. #

AT DAVIS DAM DEDICATION.—Mrs. Arthur Powell Davis and Region 3 Director, E. G. Nielsen, examine the bronze memorial plaque honoring Arthur Powell Davis, for many years chief engineer and Director of the Reclamation Service, who planned the present development of the Lower Colorado River through the construction of four high dams—Hoover, Parker, Imperial, and Davis. By a happy coincidence, Mrs. Davis, widow of the famed engineer, also celebrated her birthday on the day of the dedication, December 10, 1952. Arthur Powell Davis' nomination to Reclamation's Hall of Fame appears in the February 1950 issue of the RECLAMATION ERA.

CROPS

High Crop Values in California and Oregon

According to a preliminary report from the Bureau of Reclamation's Region 2 headquarters at Sacramento, Calif., irrigation farmers who received all or part of their irrigation water supply from Bureau of Reclamation sources in California and Southern Oregon raised crops valued at $190,309,732 in 1952.

These crops were produced on the Klamath project in southern Oregon and northern California, the Orland project in northern California, and in various areas of the San Joaquin Valley and Delta area of California which are served by the Central Valley project.

Bureau of Reclamation water deliveries in 1952 represent about half of the total crop requirements of 38 irrigation and water districts being served by the Central Valley project. All water needs of the Klamath and Orland projects are met through project deliveries.

Cotton was the most important single crop raised in these areas, both from a standpoint of acreage planted and cash value. Irrigation districts which received a supplemental water supply from CVP raised 413,000 bales, or 23 percent of all cotton raised in California. Its cash value, including both lint and seed, was $84,547,000.

The next most valuable crop raised in the project areas was fruit and nuts, with a cash value of $33,834,744, produced on 123,044 acres.

The third ranking crop from a standpoint of financial return was potatoes, with a total Region 2 value of $24,343,-342, the report to the regional director stated.

With 590,776 acres under supplemental irrigation from reclamation sources, the Central Valley project area had the highest cash return on its vast variety of crops, or $155,731,000.

The Klamath project, with 187,000 acres irrigated from reclamation sources in California and Oregon, produced crops valued at $30,758,000.

Orland project farmers produced crops valued at $1,819,000, grown on 17,160 acres in California's oldest reclamation project, the preliminary report stated. #

Belle Fourche 1952 Crops Worth Almost Half Project Cost

Crops raised on the Belle Fourche project in South Dakota in 1951 had a gross value of $2,238,136. This represented an increase of $246,622 over the 1950 return or an average of $42.98 per acre for 1951 as compared with $36.36 per acre in 1950. The estimated value of crops grown on the project in 1952 is $2,350,000 which is 47 percent of the total cost of the project to date. In other words, in 1 year, irrigation farmers on the Belle Fourche project, raised crops with a gross value equal to almost half the total Federal investment in constructing the project so far. ●

LETTERS

Thank You, Admiral!

President's Committee on Employment
of the Physically Handicapped,
U. S. Department of Labor.,
Washington, D. C., October 28, 1952.

DEAR EDITOR: Your October issue of "The Reclamation Era" publication has been reviewed with much interest. It is full of interesting subjects.

We were especially interested in your story on pages 237–238 entitled "Ready, Willing, and Able." It has always proved effective to do a story of an individual in your own organization. In this case you have selected a very interesting success story of a handicapped person.

It was also interesting to note your treatment of disabled veterans along with handicapped nonveterans who are working on the Columbia Basin project.

Thank you for your second year in a row of cooperation and a fine contribution to the physically handicapped program.

Cordially,

Ross T McIntire,
Chairman.

Cordiality From Colombia

BOGOTA, *July 1, 1952.*

BUREAU OF RECLAMATION,
DEPARTMENT OF INTERIOR,
Washington, D. C.

GENTLEMEN: In the name of the institute which I manage, permit me to send you my most cordial congratulations on the completion of the fiftieth anniversary of work on the great projects of land irrigation and power generation carried out in the United States durin those 50 years of life.

I also acknowledge my gratitude fo the attention, information, and instruc tion received in the International Re lamation Conference held in the Colum bia River Basin at which conference represented the Republic of Colomb

The said instructions and informa tion obtained in the Columbia Basi are of great usefulness in Colombia fo our projects in engineering and electrif cation.

The magnificent and marvelous wor performed by the Bureau of Reclam tion for the benefit and greatness of th people of the United States and as a example and instruction of human constitute a stimulus and spur for n tions beginning to develop.

Very sincerely,

Instituto Nacional De Approvech miento De Aguas Y Fomento Electric
JULIAN COCK A., *Manager.*

RECLAMATION ERA *readers may r call the article entitled, "Welcom Stranger!" which appeared on page 2 of the August 1952 issue. The abo letter was received too late to appe in connection with the article—Ed.*

A Bell Letter

The following letter indicates th westerners as well as the RECLAMATIO ERA *"get around."*

To new reader Bell and all othe interested in Reclamation, the year subscription cost of the RECLAMATIO ERA *is $1.50 for 12 issues a year, wi a special rate for Bureau of Reclam tion employees, and members of wat user organizations which work with t Bureau of Reclamation in its job western water resource development.*

35 LEWIS AVENUE,
BILLINGS, MONT.,
October 18, 195

DEAR MRS. SADLER: Have just r turned after spending the day at Gra Coulee Dam and while there saw yo publication RECLAMATION ERA, Octob 1952 issue which tells the effect Hungry Horse Dam on the Colum River projects.

Please send me a copy of the Octob issue and put me on your mailing l telling me the cost.

Sincerely yours,

G. A. W. BELL, Jr.

Sentiment From Sunnyside

Box 22,
SUNNYSIDE, WASH.,
September 8, 1952.

...: MRS. SADLER: Please send me ...ptember issue, because I do not ...o miss even one issue. I enjoy ...RA" and get much good from it. ...nk you,

QUENTIN G. GOODWIN.

A Good Investment

...CHMAN INVESTMENT CO.,
112 North Fourth Street,
Pasco, Wash.,
September 23, 1952.

... MRS. SADLER: Your article, ...mbia Basin's Showplace," in the ...mber 1952 issue of the RECLAMA-...ERA, to the writer is most inter-... and I should like to pass on a ...pies to my friends and clients.

... truly yours,

E. T. CHURCHMAN.

...ngressman Hallauer and Hungry Horse

House of Representatives
State of Washington
Thirty-second Legislature

OROVILLE, WASH.
January 2, 1953.

...AR MRS. SADLER: In your October issue an excellent article entitled ... Down Stream Dynamics of ...ry Horse" appeared. This article ...the accompanying picturegraph ...ery easy to understand.

...hink it would be of considerable ...st in the Northwest if similar ...es could be carried explaining in ...r simple fashion the results an-...ted from Libby, Hells Canyon, and ... multipurpose projects now in the ...ing stage.

Yours truly,

WILBUR G. HALLAUER,
State Representative,
1st District.

RELEASES

...n-Year Reclamation Program ...eported to New Congress

...7-year program for the continued ...lopment of the West's water re-...ces which is designed to supply new or supplemental irrigation water to 3,111,700 acres of land and the installation of 2,866,500 kilowatts of hydroelectric generating capacity was forwarded to the Eighty-third Congress during the first week in January.

The submittal was made in response to a request from the chairman of the House Interior and Insular Affairs Committee of the last Congress that a "factual, concise and current reference on Federal Reclamation" be made available to the Committee of the incoming Congress. A similar request was fulfilled for the Eighty-first Congress. Information contained in the report can provide Congress with the frame-development of natural and water resources.

The program includes presently authorized reclamation projects, many of which are already in the construction stage, some on which preliminary investigations have been completed and are ready for submittal to Congress, and others which are still in the planning stage. The entire program is designed to accomplish the greatest results at the most economic rate of progress and is contingent upon future authorization of some projects and appropriations made by the Congress. Many of the projects listed for investigation are not planned for construction within the 7-year program. A copy of the report, entitled "The Reclamation Program, 1953–59" is available upon request to the Bureau of Reclamation, Washington 25, D. C. #

Report to the Stockholders

Celebrating its Golden Jubilee, the Bureau of Reclamation has published a Financial Report covering 50 years of reclamation in the 17 Western States.

For the first time, the financial activities of the Bureau over the past 50 years are published on a consolidated basis. The report presents an interesting story on the Government's investment, its accomplishments, and its plans for the future. It tells the story of what the Bureau has done with over 2 billion dollars—converting it into a water supply for over 6 million acres of fertile arid lands and providing more than 4 million kilowatts of electric generating capacity to serve the farms, homes, and industries of the West. It also shows how the Government will recover its investment through power revenues and repayment contracts on irrigation works.

The report entitled, "50 Years of Reclamation" will be of great interest to those concerned with reclamation in the West and copies may be secured without charge at the Washington and Regional Offices of the Bureau of Reclamation. #

Corrections on Columbia Basin Story

We received the following corrections for the article entitled, "Operating the Columbia Basin Project," too late to correct the February 1953 issue. On page 32, second paragraph, instead of 15 years to construct canals and laterals for irrigating the first 500,000 acres, change it to 5 years. According to the 7-year program, facilities for irrigating this acreage should be complete by the end of 1958. In paragraph 4, line 5, the Burbank acreage should be changed to 1,200 acres, instead of 1,600. On page 34, line 3, the word "gatetender" should be substituted for "watermaster." On the same page, next paragraph, top line, insert the word "or" so the sentence reads "deep, or swiftly flowing water." #

As this issue goes to press, Secretary of the Interior, Douglas McKay, has authorized Assistant Secretary of the Interior, Fred G. Aandahl, to exercise all of the authority and perform all of the functions of the Commissioner of Reclamation. Aandahl, former Governor of the State of North Dakota, was confirmed and designated as Assistant Secretary of the Interior for Water and Power Development on February 10, 1953.

In pursuance of Secretary McKay's instructions, Assistant Secretary Aandahl designated Assistant Commissioner of Reclamation, Goodrich W. Lineweaver, to be responsible, under his direction, for the coordination and supervision of Bureau of Reclamation activities on February 12, 1953.

The resignation of Commissioner of Reclamation, Michael W. Straus, was accepted by President of the United States, Dwight D. Eisenhower, as of the close of business, February 6, 1953.

NOTES FOR CONTRACTORS

Contracts Awarded During January 1953

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Con... am...
DC-3752	Missouri River Basin, Mont	Jan. 7	Completion of Canyon Ferry Dam, power plant, and switchyard.	Eisenman, Seabrook, and Elliott, Chula Vista, Calif.	$59
DS-3800	Central Valley, Calif	Jan. 12	Three 3,000-ampere generator-voltage bus structures with current and potential transformers, generator-protective equipment, grounding and disconnecting switches for Folsom power plant.	I-T-E Circuit Breaker Co., Philadelphia, Pa.	14
DS-3824	do	Jan. 8	One 600-kilovolt-ampere unit substation and one 460-volt power distribution board for Nimbus power plant.	Northeastern Engineering, Inc., Manchester, N. H.	
DS-3828	Boulder Canyon, Ariz.-Calif.-Nev	Jan. 13	Seven vertical-shaft, turbine-type pumping units for L-1, L-2, and L-3 pumping plants, Coachella Valley distribution system, unit 8, schedule 1.	Fairbanks Morse & Co., Kansas City, Mo.	2
DS-3829	Gila, Ariz	Jan. 2	Five vertical-shaft, centrifugal or mixed flow pumps for pumping plants Nos. 1, 2, and 3, Wellton-Mohawk Canal.	Worthington Corp., Harrison, N. J.	17
DS-3833	Missouri River Basin, Iowa	Jan. 8	One 40,000/53,333/66,667-kilovolt-ampere autotransformer with lightning arresters for Sioux City substation.	American Elin Corp., New York, N. Y.	1
DS-3837	Columbia Basin, Wash	Jan. 30	16 horizontal-shaft, centrifugal-type pumping units for Warden, North Warden, Warden relift, East Low 61, East Low 61.7, and East Low 63.1E pumping plants, Area E-5, East Low canal laterals.	Economy Pumps, Inc., Division of C. H. Wheeler Mfg. Co., Philadelphia, Pa.	1
DC-3840	Yakima, Wash	Jan. 6	Construction of earthwork, concrete canal lining, and structures for Chandler Canal.	J. A. Terteling and Sons, Inc., Boise, Idaho.	1,61
DC-3841	Missouri River Basin, Nebr.-Kans	Jan. 2	Construction of earthwork, concrete canal lining, and structures for Courtland Canal.	Platte Valley Construction Co., Grand Island, Nebr.	20
DS-3842	Gila, Ariz	Jan. 8	Five 72-inch diameter flap gates for Wellton-Mohawk Canal pumping plants Nos. 1, 2, and 3.	Columbia Machine Works, Berkeley, Calif.	2
DS-3843	Central Valley, Calif	Jan. 2	One 2-foot 9-inch by 2-foot 9-inch high-pressure gate with one 49,000-pound hydraulic hoist, 2 conduit-lining transitions, and 1 gate hanger for outlet works at Sly Park Dam.	Monarch Forge & Machine Works, Portland, Oreg.	1
DC-3844	Missouri River Basin, Kans	Jan. 20	Completion of Kirwin Dam	Texas Construction Co., Dallas, Tex.	6,72
DC-3845	Columbia Basin, Wash	Jan. 15	Construction of earthwork, pipelines, and structures for Area P-8 laterals sublaterals, and wasteways, Potholes East canal laterals, schedule 1.	Osberg Construction Co., Seattle, Wash.	1,16
DS-3846	Central Valley, Calif	Jan. 28	Four 2,500-volt motor-control equipment assemblies with control switches for the fifth pumping unit at each of the Contra Costa Canal pumping plants Nos. 1, 2, 3, and 4.	Gough Industries, Inc., Los Angeles, Calif.	1
DS-3848	do	do	Steel structures for transformer circuits and switchyard at Folsom power plant and transformer structures at Nimbus power plant.	Emsco Mfg. Co. (formerly Emsco Derrick & Equipment Co.), Los Angeles, Calif.	5
DC-3849	Missouri River Basin, S. Dak	Jan. 7	Construction of Weaver substation	D. L. Varney, Inc., Omaha, Nebr.	3
DC-3852	Columbia Basin, Wash	do	Drilling for stabilization of right bank at Grand Coulee Dam.	Service Hardware & Implement Co., Tacoma, Wash.	
DC-3853	Central Valley, Calif	Jan. 8	Construction of Camp Creek Diversion Dam and access road.	Stolte, Inc., Oakland, Calif	
DS-3854	do	Jan. 16	Eight vertical traveling water screens for Delano-Earlimart Irrigation district, unit 2, Friant-Kern canal distribution system.	Link-Belt Co., San Francisco, Calif.	
DC-3856	Rio Grande, New Mexico-Tex	Jan. 19	Construction of Picacho Arroyo Control North Branch Dam.	Pecos Valley Construction Co., Carlsbad, N. Mex.	
DC-3862	Middle Rio Grande, N. Mex	do	Channelization of the Rio Grande in Bernardo area.	Miller & Smith, Albuquerque, N. Mex.	
117C-176	Columbia Basin, Wash	Jan. 12	Distribution system, part-time farm units PT 1 and 2.	McWaters and Bartlett, Boise, Idaho	
117C-177	do	do	Lining repair, East Low canal, Station 1244 to Station 1410.	Intrusion Prepakt, Inc., Seattle, Wash	
200C-221	Central Valley, Calif	Jan. 7	Roads, drainage, and landscaping for Tracy Pumping Plant and switchyard.	Paul E. Woof, Fresno, Calif.	1
300C-47	Boulder Canyon, Calif	Jan. 5	Reconstruction of railroad crossing, Coachella Valley Distribution System.	Norman I. Fadel, N. Hollywood, Calif.	

Construction and Materials for Which Bids Will Be Requested by May 1953

Project	Description of work or material
Boulder Canyon, Calif	Construction of 10 miles of concrete pipe laterals, 4 pumping plants of 59 to 8 cubic feet per second capacities, and 2 equalizing reservoirs, part 2 of unit 8, Coachella distribution system, adjacent to the Coachella canal southwest of Indio, Calif.
Central Valley, Calif	Eight vertical-shaft, motor-driven, turbine-type pumping units having capacities ranging from 2 to 9 cubic feet per second and heads ranging from 38 to 93 feet; and 8 vertical-shaft, motor-driven, propeller-type pumping units, capacities and heads to be determined later, for Plainview Irrigation district.
Colorado-Big Thompson, Colo.	Construction of 12.5-mile 200-cubic feet per second Boulder Creek supply canal, an earth structure to
Colorado-Big Thompson, Colo.—Continued	convoy water from the St. Vrain supply ca... Boulder Creek.
Do	Installation of 1 transformer for Gunnison sub...
Colorado River Front Work and Levee System, Calif.	Fabricate, assemble, and launch 1 steel-hull, powered tugboat, complete with equipment... machinery, for towing 670-ton dredge on the... orado River, near Needles, Calif.
Columbia Basin, Wash	Construction of 6 pumping plants and insta... of the pumping units for lateral Area E-5 o... Low canal, near Warden, Wash. Also f... and lay 2 miles of 18- to 60-inch diameter rei... concrete pressure pipe, steel pipe, and ... electrical equipment.
Do	Construction of 85 miles of Area E-5 lateral...

Construction and Materials for Which Bids Will Be Requested by May 1953—Continued

Project	Description of work or material
a Basin, Wash.—nued	laterals, and wasteways, varying from 350 to 2 cubic feet per second capacities.
I	Construction of 35 miles of unlined laterals, sublaterals, and wasteways, varying from 2 to 50 cubic feet per second capacities, for Area W-7 on West canal, near Quincy, Wash.
I	Construction of 1 mile of unlined 250 cubic feet per second ditch, an extension to the PE16.4M12 wasteway in lateral Area P-1 on Potholes East canal, 9 miles west of Othello, Wash.
L	Construction of 60 miles of laterals of 12 to 2 cubic feet per second capacities, 6 miles of wasteways, and 5 outdoor-type pumping plants for Area P-9 on Potholes East canal, 10 miles north of Richland, Wash.
	Eight automatic radial gates, capable of discharging variable amounts of water from 7 to 21 cubic feet per second. Designs are to be supplied by the contractor.
am, Ariz	Erecting steel structures and installing electrical equipment for Knob substation, 8 miles west of Yuma, Ariz.
es, Oreg	Construction of cattleguards for the North Unit lateral system, near Madras, Oreg.
yo	Construction of Prospect diversion dam and canal, near Farson, Wyo., will include 225 feet of earth dike, a rock weir 4 feet high and 70 feet long, and 0.5 mile of 150 cubic feet per second Prospect canal.
iz	Construction of the Water Users Administration Building is to be a pumice block, nonbasement structure, 9,160 square feet in floor area, for Wellton-Mohawk division located 1.5 miles east of Wellton, Ariz. Furnishing and installing a refrigerated air-conditioning system.
	Construction of 2.4 miles of 220 cubic feet per second Dome canal and 2.6 miles of 100 cubic feet per second lateral D-1.4E, near Dome, Ariz.
	Construction of 22 miles of unreinforced concrete lined laterals and sublaterals of 45 to 15 cubic feet per second capacities for Unit 4 of Mohawk distribution system, near Wellton, Ariz.
k, Wyo	Making necessary repairs on existing ditch rider's house at Alcova Dam Government camp; and dismantling, moving from Kortes Government camp, and reerecting 1 prefabricated residence.
ka, Idaho	Constructing laterals from irrigation wells on the North Side pumping division, near Rupert, Idaho.
	Drilling and casing 20 irrigation wells on the North Side pumping division, near Rupert, Idaho.

Project	Description of work or material
Missouri River Basin, Iowa.	Main control board, distribution boards, and battery charges for Sioux City substation.
Missouri River Basin, Mont.	Construction of 2,500-kilovolt-ampere Crow Creek substation and 0.4 mile of 4.16-kilovolt-ampere distribution line, 4 miles south of Toston, Mont.
Do	One 920-foot long, 52-inch inside diameter, steel discharge pipe for Crow Creek pumping plant.
Do	One 115-kilovolt, 800-ampere, 1,500-megavolt-ampere oil circuit breaker for Little Porcupine switchyard.
Do	One 300-kilovolt-ampere, 3-phase, 34,400 delta-480 grounded wye-volt, self-cooled power transformer for Little Porcupine switchyard.
Missouri River Basin, Nebr.	Construction of 18 miles of unlined Cambridge canal's fourth section, including drains and channel changes with appurtenant reinforced concrete structures. Canal ranges in capacity from 125 to 30 cubic feet per second.
Do	Construction of 7 miles of unlined laterals ranging from 12 to 6 cubic feet per second capacity, with appurtenant reinforced concrete structures for the second section of Cambridge canal.
Missouri River Basin, N. Dak.	Placing footings, erecting about 20 steel towers, furnishing materials and stringing aluminum conductors and steel overhead ground wires for the extension of Garrison-Bismarck double-circuit 230-kilovolt transmission line into Garrison switchyard. Placing footings, erecting 1 steel tower, furnishing and stringing aluminum conductors and steel overhead ground wires for the extension of Willston-Garrison 115-kilovolt transmission line into Garrison switchyard.
Palisades, Idaho	The Snake River bridge is to be a 3-span continuous deck plate girder bridge, with end spans 136 feet center to center of bearings and the center span 264 feet, for the Wyoming State Highway.
Do	One autotransformer, 115- to 69-kilovolt with 12.5-kilovolt tertiary, 5,000-kilovolt-ampere, self-cooled, with tank-mounted lightning arresters and a grounding transformer.
Do	Seven 115-kilovolt, 1,200-ampere, 3,500-megavolt-ampere, 3-pole, and 1 69-kilovolt, 600-ampere, 1,000-megavolt-ampere, 3-pole oil circuit breakers for Palisades switchyard.
Do	One metal-clad unit switchgear which includes 2 15-kilovolt, 600-ampere, 250-megavolt-ampere air circuit breakers for Palisades switchyard.
Riverton, Wyo	Excavation of intercepting ditches for drainage purposes near Riverton, Wyo.
Do	Conversion of Pilot Butte power plant to semiautomatic operation.

United States Department of the Interior, Douglas McKay, Secretary
BUREAU OF RECLAMATION OFFICES AS OF FEBRUARY 15, 1953

Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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The Reclamation Era

Official Publication of the Bureau of Reclamation

April

1953

IN THIS ISSUE:

Part 1—Nitrogen in the West

Reducing the Risk in Reclamation Farming

April 1953

Volume 39, No. 4

The Reclamation ERA

35 Years Ago In The Era

WAYS TO BETTER DAIRYING

Better results in dairying, according to specialists of the United States Department of Agriculture, may be secured by proper sanitation and care in producing and handling milk; by better care and utilization of pastures; by raising on the farm adequate supplies of roughage, particularly legumes—alfalfa hay on the projects—and silage to take the place of grains so far as is practicable; by preserving for dairy purposes all the high-producing animals and eliminating those that are inefficient; by feeding according to production so as to secure the greatest yield of milk with the least quantity of feed, which necessitates a record of production of individual cows; by the full utilization in the community of good bulls throughout the entire period of their usefulness and to their full capacity; and by the prompt control of disease.

(From an article on page 148 of the April 1918 issue of the RECLAMATION RECORD, predecessor to the RECLAMATION ERA.)

OUR FRONT COVER. Miss La Quita Corbett, who is admiring the pretty blossoms which bring wealth to irrigation farmers through seed production. This photo was taken on the North Unit of the Deschutes project in Oregon by Phil Merritt, Region 1.

OUR BACK COVER is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners Kittredge and Coolidge.

DESIGN AND ILLUSTRATIONS by Graphics Section, Bureau of Reclamation, Washington, D. C.

R. F. Sadler, Editor

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In this issue . . .

RECLAMATION PLACE NAMES IN THIS ISSUE

NITROGEN IN THE WEST

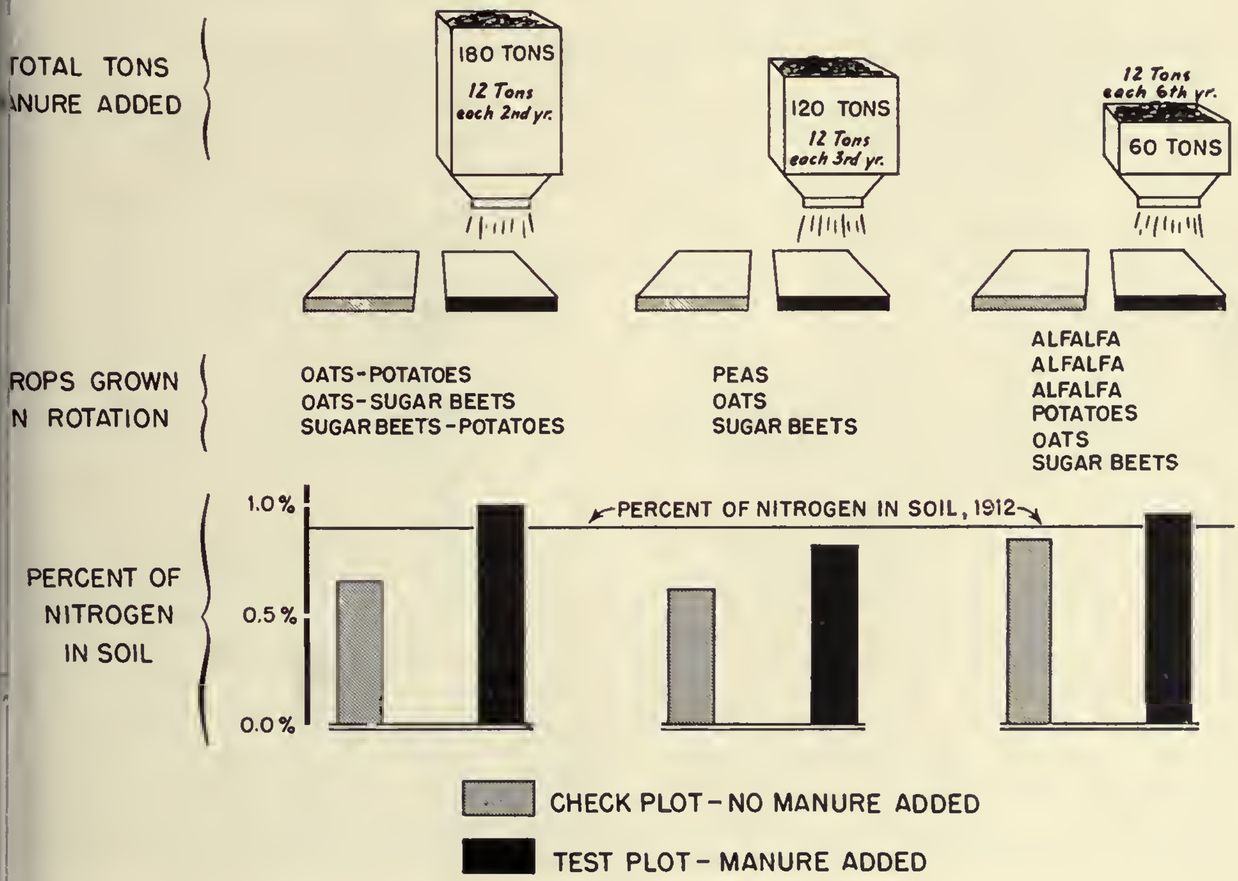
Part 1—Past and Present Trends in Nitrogen Use

by OMER J. KELLEY
Head, Division of Soil Management
Irrigated and Dry-Land Regions, United States Department of Agriculture

ITOR'S NOTE: The following article represents a con-sation of a paper presented at the annual banquet of Western Soil Science Society at Corvallis, Oreg., on ie 18, 1952.

NITROGEN FERTILIZERS ARE INCREASING CROP LDS all over the West. Research has shown clusively that nitrogen is the most deficient nt food element in western soils. This applies both irrigated and dryland soils. However, atest response to nitrogen fertilizers occur der irrigation where moisture is not limiting. esent information leads us to believe that nitro-n fertilizers already are responsible for marked creases in crop production in the West. And, there is every reason to believe that we still haven't tapped the potential of crop production that nitrogen can help us attain.

What has been the trend in nitrogen fertilizer use in the past and where are we going in the future? First, let's look at the consumption of nitrogen in the 17 Western States in past years. This is shown in figure 1. You will note that consumption has increased considerably since 1945. And if we had presented figures for depression times, you would have seen quite an increase in 1945 over those of the thirties. What about the future? Most agriculturists are predicting that consumptive use will continue to go up, at least



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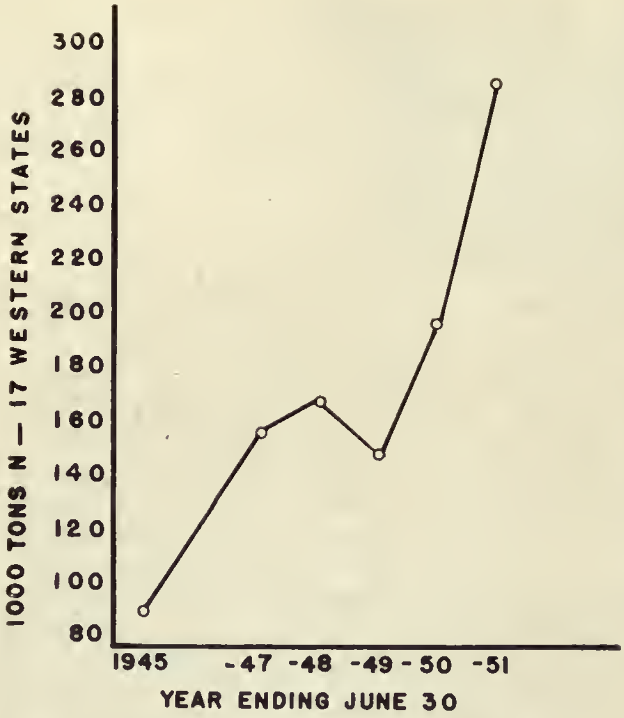


Increase in nitrogen consumption in 17 Western States.

for the next few years. And the expansion planned in the fertilizer industry assure us of plenty of nitrogen.

Soil Nitrogen Levels Are Declining

Nonlegume crops take a lot of nitrogen out of the soil. For example, a 60-bushel corn crop removes about 95 pounds of nitrogen per acre; a 30-bushel wheat crop removes 50 pounds, and a 15-ton sugar beet crop removes 115 pounds. This is replaced in part by growing legume crops and from barnyard manure. But there is usually quite a gap between removal and replacement, particularly on irrigated farms where numerous cash crops are grown.

Why do we need nitrogen fertilizers so badly on irrigated soils? The best way to answer this is to show what happened during 30 or 40 years on the same piece of land at Scottsbluff, Nebr. The illustration on page 73 shows how without either alfalfa or manure, the soil nitrogen decreased about 30 percent below that originally in the soil. Without alfalfa in the rotation, manure can maintain or slightly improve the nitrogen status—but it takes a lot of manure. As shown in the illustration, 12 tons applied every other year did the job; 12 tons every third year allowed the nitrog status to decline. Even 3 years of alfalfa out every 6 failed to maintain the nitrogen status u less manure was added. So it isn't easy to ke the nitrogen level of irrigated soils from decli ing. Very few farmers produce 6 tons of manu per acre per year, and not many keep their la in alfalfa half of the time.

The trends in these data are clear-cut and co clusive. Unless unusually large amounts manure are used in conjunction with alfalfa the rotation, we are going to lower the nitrog content of our soil. And, in the West, the wasn't much nitrogen there in the first place. T average farmer using a couple of years of alfal in the rotation plus what little manure he c salvage just isn't going to do the job. Unless applies nitrogen fertilizer his nonlegume cro are going to suffer from lack of nitrogen.

NEXT MONTH.

HOW NITROGEN FERTILIZER INCREASES YIELDS

OR

NITROGEN AND YOUR DOLLAR

Trade and Reclamation

A 1 percent sample study of waybills conduct by the Interstate Commerce Commission in 1 indicates that 1,544,300 cars weighing 39,820, tons were shipped into the 17 Western States fr the 31 Eastern States and 2,210,400 cars weighi 71,927,900 tons were loaded in the 17 Weste States for shipment to the 31 Eastern States.

Machinery, merchandise, and equipment weig ing 525,000 tons were loaded into 29,200 frei cars and shipped to the 17 Western States fr the New England States. The Middle Atlan States dispatched 162,000 cars weighing 4,042, tons and the Industrial Great Lakes States additional 608,000 cars weighing 13,353,000 t to the 17 Western States area. The East So Central and the South Atlantic groups provi 99,200 and 84,700 cars weighing 1,058,800 1,134,500 tons, respectively, for the same are

Significantly, the carloading and tonnage ures covered by Interstate Commerce Commiss analyses include railroad shipments only and d not prorate the 162 billion ton-miles of shipme carried by motor trucks in the Nation during 1

PROFITABLE PASTURING by Hubert Peckham. In photo above, sheep keep ditchbank clean and will pay off well when they go to market. Below: "Upside-down fence." *All photos by Stanley Rasmussen, Region 1.*

DITCHBANK PASTURING AND ITS BENEFITS

by WILLIAM H. TULLER
Regional Supervisor of Operation and Maintenance
Boise, Idaho, Region 1

No unsightly weed infested farm ditch banks. No expensive maintenance problems. Profitable lush green pastures only. Those are the aims of Hubert G. Peckham. He and his son supervise farming operations on 560 acres of fertile irrigated land on the Wilder bench of the Boise project in Idaho.

Mr. Peckham, like many other progressive irrigation farmers, long ago discovered the unprofitableness and unsightliness of overgrown ditch banks. He believes irrigation district officials and the farmers should cooperate in controlling weeds on irrigation laterals.

Mr. Peckham's farm is a perfect example of using ditch banks profitably, and maintaining them in excellent condition with a minimum of effort and expense. Mr. Peckham markets a car-

Weed-infested lateral requires continuous cleaning.

Pastured lateral provides clean, well-preserved waterway.

load of lambs each year from his double fenced, ditch bank pasture. This is in addition to the pasture required for the ewes.

To make the maximum use of his fenced ditch banks, Mr. Peckham resorts to the unique practice of placing the woven wire "upside down" on the fence posts. In this case, "upside down" is "right side up." Peckham places the large mesh at the bottom of the fence. This permits the sheep to reach through and pasture on the other side. As they nibble away along the fence row, they neatly trim a 12- to 16-inch strip at the edge of the cropped field. This fence line pasturing becomes a multiple purpose operation. Weeds are kept under control. Weed seeds do not spread to the crops. Mowing, raking, and combining the crop is made much easier. Gone is the hazard of striking the fence or fence posts with farm implements. Crops which might otherwise be lost during harvesting are used in the production of mutton.

The sheep do very little damage to the sod ditch banks. On the contrary, their pasturing activity in the fenced-in area cuts down on several other maintenance chores. Weeds and grass which normally infest farm ditches are kept under control. Weeds do not spread over the farm. Water flows unobstructed in the ditch throughout the summer. No longer must supply ditches, as well as ditches which provide for the disposal of waste water, be cleaned once a year. A cleaning once in 4 or 5 years is sufficient.

Mr. Peckham points out that a good pasture is one of the best crops to grow from the standpoi[nt] of returns on the Boise project. That is why [he] is willing to use plenty of ditch bank space f[or] this profitable venture. Generally speaking, [he] sets his fences 6 to 8 feet from the ditch ban[k]. Along the head ditch this extra area allows f[or] proper distribution of water before it reaches t[he] cropped field. It also helps to collect runoff [at] the other end of the field.

Mr. Peckham believes the secret of maintaini[ng] good fences lies in initial construction. He est[i]mates that his fences, which were erected in a ve[ry] substantial manner, cost about $4 per rod. Corn[er] posts are 10 feet long, and are driven 5 feet [...] inches into the ground. Fence posts, placed 12[...] feet apart, are uniformly 4 feet 8 inches hig[h]. The woven wire fence is 47 inches in heig[ht] with 6-inch stays. When occasion requires, Pec[k]ham strings one or two strands of barbed wi[re] at the top of the woven wire.

Mr. Peckham takes pride in keeping his dit[ch] banks clean, neat, and free from unsightly wee[ds].

"No weeds and lots of good pasture on dit[ch] banks" is the way Mr. Peckham sums up h[is] system. # #

HAVE YOU CHANGED YOUR ADDRESS LATELY? GOING TO MOVE SOON?

Let us know immediately so we can change our mailing list—it takes time, you know.

We'll do our best to deliver the Reclamation Era to your correct address, but we have to know what it is.

SAFETY

on the Columbia Basin Project

by HAROLD E. WERSEN
Columbia River District Safety Engineer
Columbia River District, Ephrata, Wash., Region 1

"Kids are playing on the canal bank," the voice on the phone complained.

We received this call in the Columbia River District Office at Ephrata, Wash., one day last year, early in the irrigation season. The voice was that of the Bureau of Reclamation Watermaster stationed at Dry Falls Dam near Coulee City, Wash. It is here that the Main Canal of the Columbia Basin project takes off from the 27-mile storage reservoir that was formerly the ice-age channel of the Columbia River. The Watermaster's problem was at the taking-off point, where most of our safety worries in connection with the Nation's largest reclamation project begin—canal operation.

"They're rolling boulders into the water at the headworks. They're going to jam up a gate. If one of the boys slips, we're going to lose a boy," he continued.

The call was no sooner received than we were able to start a series of wheels moving, leading to corrective action that now is almost routine on this project.

We called civic leaders and school officials and arranged a series of canal safety meetings with the children in the schools and with the parents at P. T. A. in the evening.

Our information officer discussed the problem with the editor of the Coulee City News, Joe Pierce. The editor, already interested in canal safety, ran an editorial campaign accompanying the meetings. In the press or at our meetings, he never lectured. He merely stressed the urgency of the situation.

Almost immediately, the results came in. Our watermaster reported the youngsters had stopped throwing rocks into the canal works, and they had stopped playing along the dangerous rock cut, which in some places, at this point drops 90 feet in a jagged vertical chasm.

Action in this particular case could be taken quickly because of advance work which had been done long before the first water had been turned into the canals for testing. In each school district, at least three meetings had been held on the safety program.

Since then, local community groups have been formed at Coulee City and about a dozen other towns in this new project area. These can, and do, go into action on their own when a situation such as the one above arises.

Fishing is a case in point. If there's anything a boy on vacation loves, it's fishing. Our cool, green canal waters, pumped from the Columbia River, also pick up some nice fat bass on their long trip to the irrigable land.

Kids learned to loop their lines over the protecting wire fence into the canal. Soon that wasn't enough, however, and they went crawling down ladders inside the fence, to the water's edge. One of these locations was at the mouth to the Ephrata siphon. One overanxious lunge in landing a whopper, and there was slim chance that the youngster would get out alive.

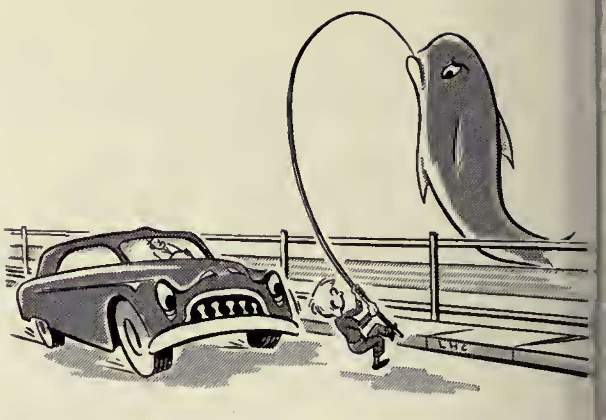
The local chief of police chased the boys out. The local editor, Jim Simpson of the Grant County Journal, aware of the safety campaign, called to tell us the boys were fishing in a dangerous area. We think we have the boys convinced it's safer from behind the fence. Next fall, we'll start more education campaigns in the schools.

Near Quincy, one youngster out fishing almost became a highway casualty—not a water victim. Fishing from the highway bridge, he became so excited in landing a big one, that he stepped backward into the path of an approaching car.

Children throughout the basin are very receptive to the canal safety meetings. They come in, shoving and shouting as all children do, but the minute the program starts, they are perfectly attentive.

The Columbia Basin project's safety and health problems are largely those of any new project, with one exception—there are larger canals and more of them. That is why community safety and health committees were organized.

When water first went into the canals for testing during the late summer and fall of 1951, most of the people of this area had never had any experience with large, treacherous, but innocent-appearing bodies of water.



When I mentioned this point at a communit meeting in Quincy, a woman spoke up and sai "That's right. He knows what he's talking abou Most of you have never seen more water than yo can get in your bathtubs. I've been on irrigatio projects most of my life. They *are* dangerous!

Health problems, such as garbage disposal an rodent control, manifested themselves as burea residency camps pushed themselves into new co struction areas adjacent to oldtime towns.

We embarked on an organized drive, in coopera tion with the county sanitation and health offic in the counties involved, so that these problen could be solved by the people themselves.

Community safety and health groups are an e tablished fact in such growing city centers a

Please turn to page 87

AUTHOR WERSEN (standing at head of room on right) in low left photo attends safety conference of Bureau employees.

SIPHON MOVIE HOUSE. Crew of J. A. Terteling and Sons' con workers view safety movie in Columbia Basin siphon, belo right. *Both photos by Harold E. Foss, Region 1 photograph*

Reducing the Risk in Reclamation Farming

How have soldier-settlers fared on their Reclamation farms?

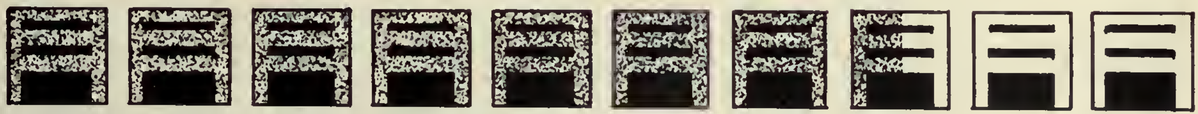
The Bureau of Reclamation recently made reconnaissance survey of the progress of new Reclamation farmers, mainly veterans of World War II. We found out that of the farms which were settled from 2 to 6 years, 87 percent or 751 of the units are held by the original owners. Only 112 (or 13 percent) have changed hands. On non-Reclamation farms in the Mountain and Pacific areas (where Reclamation projects are mainly located) approximately 250 farms or 25 percent would have changed hands in the same period according to the Bureau of Agricultural Economics. According to the Department of Commerce, during the same period less than 25 percent of all new private businesses are retained by the original operators. The remainder have been resold or liquidated.

Accordingly, it can be safely stated that these newcomers to Reclamation farming have made an excellent record, compared with non-Reclamation farmers and operators of small businesses.

Since December 1946, veterans have settled on 1,186 public land farms on Reclamation projects in the 17 Western States. The Tule Lake Division of the Klamath project in California and Oregon was the first area on which postwar farms were awarded. In this case 2,028 applications were received for the 86 farms awarded. Other land openings were held on the Gila and Yuma projects in Arizona; Boise and Minidoka projects in Idaho; Columbia Basin and Yakima projects in Washington; and the Riverton and Shoshone projects in Wyoming. The survey was based on the total of 863 farms rather than the overall total of 1,186 farms. The 863 have been settled for 2 years or more. The other 323 farms have been occupied less than 2 years, and are just getting under way.

On the 863 established farms, 128 of the settlers have been farming their original unit for 6 years. This represents 76 percent of the original 168 settlers. Only 40 of the new settlers of 6 years ago have left. During the entire 6-year period only 112 new settlers gave up their reclamation farms. Most of them, or 81 of the 112, sold their farms for a profit. Nine gave up because they found out they didn't have the necessary managerial or farming ability. Six had personal likes or dislikes which caused them to leave. Another six lost out because of financial difficulties. Four of the settlers got into "title trouble." Their entries

AFTER 6 YEARS • • •



75% of new private businesses changed hands

25% of non-Reclamation farms changed hands

13% of Reclamation farms changed hands

were contested. Four left reclamation farming because of death or sickness in the family. Only two relinquished their land because of what they considered its poor quality.

This record is far different from that of the early days of reclamation, when the rapid turnover of reclaimed farms gave credence to the statement, "It takes three generations of farmers to develop a new irrigated farm."

How were they able to make such a good record in such a short time?

One of the reasons might be found in the fact that these new entrymen to the Reclamation scene have to meet certain minimum requirements including at least 2 years of actual farming experience. They also must have a minimum amount of capital. The amount required varies from project to project but usually ranges from $3,000 to $5,000. This is only enough to barely get started and new settlers usually have to borrow considerable sums of money.

This is not the whole story, however.

The new crop of settlers has been working with a team of specialists from Federal, State, county, and local agencies who are interested in helping irrigation farmers make the most of their opportunities.

The State colleges, and several branches of the United States Department of Agriculture, have signed a total of 151 Memoranda of Agreement with the Bureau of Reclamation to help provide "know how" to these new farmers. Thus, today new settlers have the benefit of the experience gained during a half century of irrigation farming in the West. What's more, they are aware of the existence of this helpful information, seek it at every opportunity, and welcome the advice and assistance thus provided.

Development farms on many Bureau projects have been in operation for some time. They are designed to determine the best crops to grow in certain soils, to show which crops should be rotated and how often, and how to conserve and use irrigation water.

LOCATION MAP FOR
POSTWAR FARMS
FOR VETERANS

RAILROAD RAIL is used as drag to clear sagebrush by J. W. Davidso… diate right Dee Harris, Assistant Agricultural Agent, handles the l… at Pasco. ***Top photo by F. B. Pomeroy, right photo by H. E. Foss, both***

LAND LEVELING by "Landplane" on J. F. D'Ewart's unit, Pasco area, Columbia Basin project.

THE WILLINGHAMS of Pasco getting the wash out with Junior's help. ***Photos by H. E. Foss, Region 1.***

VETERAN SETTLERS Bruce G. Gillette and M. L. Marlowe (immediately below) dismantling WRA poultry building at Lingle, Wyo., for removal to Riverton, Wyo. Pete and Mrs. Milihov confer with carpenter on remodeling plans for their home at Shoshone Heart Mountain. Young Miss Milihov gets into the act. At bottom settlers Mr. and Mrs. Bovee, of Heart Mountain, irrigate a shelterbelt. Extension Service and Reclamation Bureau aided in establishing windbreaks.

above at right. Imme-
ttler D'Ewart holds rod

How have the settlers put this advice into practice?

They have made remarkable progress in developing their land. Of the total 863 units, 50 percent of the settlers had developed more than 50 percent of their land at the end of the first year. At the end of the third year almost all of them had-three fourths or more than 75 percent of their land in production.

When it came to evaluating how well these farmers laid out their distribution systems, most of them were classed as "good." Those considered "excellent" outnumbered the ones classed as "poor." Actual construction of the distribution systems on the new farms was not considered as good as the layout. Many of the new settlers install temporary wooden structures in the beginning. As soon as their farm income permits, they plan to install permanent laterals, turn-outs, checks and other necessary structures in the irrigation system.

Land leveling has always been a headache for new settlers on irrigation farms. But they, most probably as a result of the settler assistance program, managed to level the majority of their farms to the point where they were considered "good" or "fair." There were more units classified as "excellently" leveled than received a "poor" rating.

Perhaps the biggest problem for any new farmer is housing. While he is getting his land in shape. he must have a place to live. Most new settlers start out in makeshift shelters, some of which will later be used as farm buildings. Some settlers lived in tents for a short while until they were able to start work on more permanent homes. The Bureau of Reclamation was able to assist settlers in 13 of the land openings by providing them with World War II surplus barracks type buildings. Some of the newcomers used them "as is," while others used the lumber to build dwellings of a different type. Most of the settlers' homes were classed as either "good" or "fair." Almost a tenth were considered "excellent." About 18 percent of the residences were classified as "poor."

The average settler has net assets worth $19,000. The average varied from project to project and ranged from $5,000 to $45,000. On the average, each settler accumulated $3,240 additional capital each year. Accordingly settlers are able to purchase the required additional equipment and machinery for continued success on their irrigation farms.

Many of the settlers had automobiles, trucks, and tractors, as basic equipment when they moved to their units. At the time of the study electricity was available on 90 percent or more of the farm units. More than 30 percent of the settlers had telephones. Most of them now have wells from which they obtain their domestic water supply. In some localities settlers have cooperated in drilling a community well to provide themselves with domestic water. On projects where farmers have no domestic water supply, they haul their water, and store it in cisterns.

In most instances, the initial cash requirements were not enough. Most of the settlers have had to borrow additional money to develop their farms, build homes, obtain machinery, or to meet other expenses necessary to irrigation farming. Their major source of credit is the Farmers Home Administration. Others include commercial banks and loan companies, supply dealers and businessmen in general. The amount of money borrowed by these new settlers ranged from $300 to $27,000.

The Bureau's survey indicates that the settlers are making rapid progress. The quality of the land development is satisfactory. Their standard of living is fair to good, judged by the quality of housing, equipment, and capital accumulation. Reclamation farming appears to be a good sound American business venture. Cooperation is taking the risk out of Reclamation farming. # # #

HOME WAS A TENT for E. C. Mosebar of Pasco while permanent residence was being built. ***Photo by H. E. Foss, Region 1.***

IN CLOVER—Finest clover in the world from the North Unit of the Deschutes project in Oregon being examined, below. George Rodman of the North Unit, at left. *Photos by Stanley Rasmussen, Region 1.*

MORE BLUE RIBBONS FOR DESCHUTES SEEDS

by CARLOS C. RANDOLPH, Irrigation Manager, North Unit, Deschutes project, Oreg., Region 1

The North Unit of the Deschutes project in central Oregon still tops the world when it comes to producing Ladino Clover seed.

If that claim appears too broad, the results of the judging at the Royal Agricultural Winter Fair at Toronto, Canada, are a pretty good convincer.

Seed Growers of Jefferson County, Oreg., won more than $300 in prize money from their alfalfa, ladino, red and alsike clover seed exhibited at the Fair November 14 through 22, 1952.

Out of the 41 white clover entries, which included ladino, 26 of the prize winning entries were from the United States, and all these were from the North Unit of the Deschutes project.

In other words, out of 31 awards, North Unit farmers won all but the ninth, tenth, eighteenth, twenty-sixth, and twenty-ninth prizes. In the alfalfa seed division, one entry from the North Unit placed tenth. In the red clover division, North Unit growers garnered, eighth, ninth, and twenty-sixth places. In the alsike division which is Canada's long suit, North Unit growers again took fourth, fifth, and sixth places.

The Royal Canadian Agricultural Winter Fair is an annual event. Seed, grain, and hay entries are received from agricultural centers in Canada, the United States, and Europe. Winners in each class are recognized as world champions. North Unit project entries have consistently won top awards at the Toronto Fair, but not always in the volume shown this year.

The collection and shipment of each 10-pound entry was sponsored by the Jefferson Seed Growers Association, one of the most active grower organizations in the North Unit, Deschutes project, Madras, Oreg.

Officials of the seed, grain, and hay division of the Royal Canadian Fair toured the North Unit region in September of 1952 to observe first hand the techniques employed by project

Please turn to Page 87

A Well-kept Lateral Gathers No Moss

PART 2—CAUTIONS AND COSTS ON CONTROLLING WATERWEEDS IN IRRIGATION LATERALS

by JESSE M. HODGSON, Assistant Agronomist
Division of Weed Investigations
University of Idaho

EDITOR'S NOTE: The following article was prepared on the basis of the cooperative investigations of the Division of Weed Investigations, Bureau of Plant Industry, Soils and Agricultural Engineering, Department of Agriculture, and University of Idaho and was adapted from information contained in Idaho Extension Circular No. 123.

TREAT WATERWEEDS WHEN THEY HAVE BEGUN TO GROW vigorously and are causing a noticeable rise in the water level. Do not wait until they have reached the surface of the water. Younger plants are easier to control, and you can reduce the flow of water most conveniently at that time.

Second treatments may be necessary in 5 to 8 weeks after the first. Since aromatic solvents kill the weeds through contact with the foliage, roots and bulbs may not be damaged. During long hot summers, in the Northwest there may be enough regrowth to warrant a second treatment. In the Southwest three to five treatments may be needed. To do a good job you must have the correct timing, the correct amount of chemical for the amount of water in the ditch, and make certain the solvent is thoroughly emulsified with the water.

Temperature of the water has much to do with the growth of the waterweeds. When water is warm, the weeds grow much faster than when the water is cold.

Tests have shown that treatments in fairly clear, clean water are more effective than in water carrying a heavy load of silt or soluble salts.

Waterweeds show a darkened appearance and the plants lose their rigidity in the water soon after they are treated with aromatic solvents. The plants become limp and are forced downward by the water flowing over them. This reduces the congestion in the ditch, and the water usually flows at near normal rates within 24 hours after treat ment. The dead plants turn brown and may li on the bottom of the ditch for 10 to 20 days befor the force of the current gradually removes then Dead weeds did not become a problem in ditche or irrigation furrows in any of our tests.

Aromatic solvent waterweed treatments do no harm some crop plants. Even higher concentra tions of the solvents than those used in any of th waterweed control trials did not damage field an garden crops tested. Solvents were applied b row irrigation to potatoes, beans, sweet corn, suga beets, and carrots. Oats and wheat were treate by flood irrigation. Although sugar beets an wheat showed some reduction of yield from exces sively high concentrations of aromatic solvent there was no damage or yield reduction of thes or any of the other listed crops from concentra tions higher than those used for waterweed contro Other crops that have not been tested may be dam aged by aromatic solvent in irrigation water. Be cause we are still unsure of its effect on these un tested crops, we advise wasting the treated wate rather than risking crop injury by using it o those crops that have not been tested.

Aromatic solvents are distasteful to livestock s that usually they will not drink treated wate The quantity of solvent in water treated for water weed control is relatively small. Six gallons o solvent applied to 1 cubic foot per second of wate for 30 minutes is equivalent to 1 gallon of solve to 2,250 gallons of water. Because of this, it unlikely that livestock would be injured fro drinking the treated water. However, it woul be safest to keep thirsty animals away from water containing the solvents.

Fish and other marine life are killed by contact with the solvent. However, as aromatic solvent is lighter than water, the material evaporates a few hours after application, thereafter losing its effectiveness.

Aromatic solvents are inflammable and must be handled with the same caution required in handling gasoline. Do not breathe fumes of the solvents or let the concentrated materials come in contact with your skin for prolonged periods. Do not use around an open flame. Take every reasonable precaution.

The cost of treating irrigation ditches and laterals with aromatic solvents depends on the amount of solvents used, and labor and equipment costs. The retail price of these commercial waterweed killers in Idaho has varied from 65 cents to $1 per gallon. Enough solvent to treat 1 cubic foot per second of water for a 1-mile-long ditch costs $3.90 to $6. Labor and equipment would be a smaller item, probably not more than $2.50 per hour, or per 30-minute treatment, including time to set up the equipment.

Although some waterweed killers cost more and specifications vary, the higher priced products have not necessarily given better results than those sold for less.

Aromatic solvents from different sources and different refining processes vary in composition. Always buy commercial waterweed killers from reputable dealers. Some test failures were traced to faulty materials that did not meet the specifications for waterweed-killer solvents.

Editor's Note: Parts 8 and 9 of the "Short Cuts to Weed-Killing Calculations" which appeared in the Reclamation Era are also available in reprint form. Your nearest regional director has a limited supply for free distribution. Additional material may be obtained in the two articles appearing in the April and May 1950 issues of the Reclamation Era, entitled "Aromatic Solvents for Waterweeds," by V. F. Bruns and W. H. Farmer.

Have you a good idea on a short cut or labor-saving device to share with other water users on Reclamation projects? Send it in to your nearest Bureau of Reclamation office or to the Editor, RECLAMATION ERA, Bureau of Reclamation, Washington 25, D. C. The writing does not have to be fancy. Just make certain you have the answers to Who, What, Where, When, Why, and How in your story. As for pictures, a rough sketch or snapshot would serve our purposes. Remember, this is the only official publication of the Bureau of Reclamation, the only periodical devoted entirely to the interests of water users on projects served with facilities made available by the Bureau. It is your magazine, and will be as good as you can make it. By helping others you will also help yourself. Send your item in today.


AUTHOR APPLYING AROMATIC SOLVENTS to test plots on weed station of B. P. I. in Boise Valley to determine effects on crop plants. ***Photos by Stan Rasmussen, Region 1.***

FOUR STATES IRRIGATION COUNCIL ORGANIZED TO CUT COSTS

by L. I. HEWES, Jr., Chief, Land Use and Settlement,
Region 7 Headquarters, Denver, Colo.

Irrigators of Colorado, Wyoming, Kansas, and Nebraska have taken a major stride towards implementing a common assault on the problems of rising costs of operation and maintenance on hydraulic systems through formation of a Four-States Irrigation Council.

The Council came into being as an experiment late in 1951. About half a hundred irrigators from the four-State region got together in Denver to figure out a way they might present a united front against the bugaboo of steadily mounting costs of doing business.

The first meeting of the Council held in 1952 proved so successful that key persons attending assumed the responsibility for continuing the activity and solidifying its form. This led to the Council's second annual meeting held January 14 and 15, 1953, on the campus of Colorado A. & M. College at Fort Collins, Colo.

The second meeting was well described by E. O. Daggett, first president of the Council, when he said the gathering brought together "directors, superintendents, water masters, assistants, engineers, managers, and others who are responsible for the successful operation and maintenance of irrigation and power projects."

There were 120 persons in attendance at this year's meeting of the Council. Bylaws under which future operations of the Council will be carried on were set up and unanimously enacted. A strong slate of officers was installed.

The Council has set for its goal providing the means for irrigators to exchange ideas and information, to state problems in open meetings, and learn if solutions to those problems have perhaps been found by others present.

The bylaws enacted at this year's meeting clearly established the goals in this language: "Membership is extended to each irrigation and hydroelectric project within the State of Nebraska, State of Wyoming, State of Colorado, and State of Kansas . . ." Purpose is set forth as "to provide an opportunity for its members to cooperate in the study of the problems pertaining to the operation and maintenance of hydraulic systems to exchange experience and render aid to the mem bers in solving the problems in operating an maintaining such systems."

To direct the Council's work, a president, vic president, and secretary-treasurer were electe plus five directors, one from each of the four State represented in membership and a director-at-larg chosen from the Bureau of Reclamation.

Federal and State agencies concerned with irri gation and power developments also are include in participation in the Council's activities in orde that cooperative achievement may be realized.

While the objectives of the Council sound lofty its approach to the subject is of grassroots practi cality, as shown by the items included in th program.

Keynote for the meeting was sounded by Aver A. Batson, Director of Region 7 of the Bureau o Reclamation, who discussed "What Is New" i irrigation and power fields.

Most of the balance of the program was devote to panel discussions followed by question an answer discussion periods.

Topics dealt with included flood control, wee control, seepage control, labor and equipment, an distribution of irrigation water. Practical ex perts on each of the subjects covered preassigne subtopics under each of these general headings following which general "bull sessions" develope active audience participation.

Many of the speakers employed motion picture and slides to illustrate graphically their presenta tions. Slides were used to demonstrate variou practical techniques, such as weed control method and equipment for doing the best job; how t properly and also improperly apply water to th land; what the ravages of flood waters are whe torrents are loosed upon irrigation works and ir rigated lands, and methods and items of equip ment which are producing money-saving an efficiency-increasing results.

Plans for the next annual meeting will b drawn by the officers and board of directors wit the latter determining where the meeting shall be held. Many of the delegates voiced a desire to have future meetings held in Denver because of its accessibility and so that other business can be transacted while delegates to the Council's sessions are in the city.

Officers elected for the ensuing year were: James L. Doyle, superintendent of the Windsor Reservoir & Canal Co., Fort Collins, Colo., president; Perry Sweat, a director of Kirwin Irrigation District No. 1, in Kansas, vice president; Breck Moran, director of the State of Wyoming's resources development department, secretary-treasurer. Directors include Kyle F. Bryning, superintendent of the Rio Grande Canal Association at Monte Vista, Colo., representing Colorado; Galen Lowry, vice president of the Gering-Fort Laramie Irrigation District, representing Nebraska; A. E. Olson, vice president of the Goshen Irrigation district, representing Wyoming. The Kansas directorship remained to be filled because Sweat was at first elected to represent that State on the board and was later elected vice president of the Council. It was agreed that no officer should hold two posts concurrently and plans were being made to name a replacement for Mr. Sweat on the board. # # #

Safety on the Columbia Project

Continued from page 78

Burke, Coulee City, Coulee Dam, Eltopia, Ephrata, Mesa, Moses Lake, Othello, Quincy, Soap Lake, Warden, and Winchester.

P. T. A. groups, the American Legion, business clubs, 4–H Clubs, chambers of commerce, grade and high schools have formed the nucleus of the community groups.

Their problems are canal safety, farm home safety, traffic safety, school safety, and fire safety.

Under the preventative health education program, committees will handle rodent and mosquito control, garbage disposal, sanitary fills, sewage, and water pollution (which includes domestic water as well as water for recreational purposes).

First-aid classes are carried on by the Safety Division throughout the year and are available to anyone within the community, where the classes are scheduled.

Bureau personnel will act as advisors and furnish information for these groups in putting on their educational programs, but we will not go out to take care of their problems.

In addition to the community safety and health program, we hold periodic safety and health conferences for all of our employees, as well as contractors' employees, so that everyone in the basin will be aware of the problems and hazards involved.

Our sole purpose is to provide answers to the questions of how and why we can eliminate hazards to both safety and health. Some of our canal signs say "Stay alive by staying out." Communities also show they are alive by "staying in"—by developing the district safety and health program. # # #

NEXT MONTH
WEST-WIDE WATER REPORT

Time to Renew?

You'll find the expiration date of your subscription on the address stamped on the back of your copy of the RECLAMATION ERA. If the number at the left-hand side of the address, directly beneath the number and street reads "6–53," for example, the last issue under your subscription will be the 6th month—June—of the year 1953.

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More Blue Ribbons For Deschutes Seeds

Continued from page 78

seed growers in the production of high quality seed crops.

In 1952, about 22,500 acres of the 50,000-acre Deschutes project were devoted to the production of seed crops as compared to 27,000 acres in 1951. People around Deschutes believe the acreage devoted to seed growing will continue to decrease gradually, due to the normal change to more diversified farming, and also the difficulty in maintaining weed-free crops which is essential to high quality certified seed growing. #

NOTES FOR CONTRACTORS

Contracts Awarded During February 1953

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DS-3812	Palisades, Idaho	Feb. 24	4 35,000-kilovolt-ampere transformers for Palisades power plant.	Pennsylvania Transformer Co., Canonsburg, Pa.	$410,023
DS-3838	Central Valley, Calif	Feb. 25	6 10-foot 10-inch by 12-foot 6-inch bulkhead gates, 1 lifting frame, and 1 lot of seats, guides, and latches for turbine draft tubes at Nimhus power plant.	Schmitt Steel Co., Inc., Portland, Oreg.	22,778
DS-3839	Palisades, Idaho	Feb. 4	Steel penstock manifold and outlet pipe manifold for Palisades dam and power plant.	American Pipe & Construction Co., Portland, Oreg.	1,098,600
DS-3850	Missouri River Basin, S. Dak.	Feb. 5	1 10,000-kilovolt-ampere synchronous condenser with starting autotransformer and control equipment for Rapid City substation.	General Electric Co., Denver, Colo.	145,832
DC-3858	do	Feb. 4	Construction of Fort Randall tap-Fort Randall 115-kilovolt-ampere parallel transmission lines, each 11 miles long; and Fort Randall-O'Neil and Fort Randall-Winner 115-kilo-volt-ampere parallel transmission line extensions, each 1.7 miles long.	Malcolm W. Larson Contracting Co., Denver, Colo.	220,45
DS-3859	do	Feb. 27	14 Disconnecting switches and 2 horn-gap switches for Folsom and Nimbus switchyards, schedules 1, 3, and 4.	Schwager-Wood Corp., Portland, Oreg.	61,09
DC-3861	Missouri River Basin, Kans.	Feb. 5	Construction of earthwork, structures, and track relocation of Missouri Pacific R. R. at Kirwin Dam.	Cook Construction Co., Jackson, Miss.	966,15
DC-3865	Central Valley, Calif	Feb. 6	Construction of earthwork and structures for lateral 32.2 and sublaterals, north section, pt. 1 of unit 3, Madera distribution system.	Stolte, Inc. & Pacific Contracting Corp., Oakland, Calif.	444,13
600C-109	Missouri River Basin, Wyo.	Feb. 13	North Cody Substation and overhead ground wires for approach spans.	Long Construction Co., Billings, Mont.	33,50
617C-31	Riverton, Wyo	Feb. 9	Stockpiling and placing gravel for asphaltic membrane lining cover, Station 1247/00 to 1490/00, Wyoming Canal.	Raecke and Scott, Lander, Wyo.	13,32
701C-299	Missouri River Basin, Kans.	Feb. 24	Construction camp at Webster Dam	Trowbridge-Oehring Construction Co., Columbus, Nebr.	63,08

Construction and Materials for Which Bids Will Be Requested by June 1953

Project	Description of work or material
Boise, Idaho	Relocation and construction of community facilities at Arrowrock Dam near Boise, Idaho.
Colorado-Big Thompson, Colo.	Construction of small timber bridge and barbed-wire fencing at Willow Creek feeder canal, 4 miles northeast of Granby, Colo.
Columbia Basin, Wash	Construction of a 24-mile unlined reach of West canal, 500 to 100 cubic feet per second capacity, and Goose Lake wasteway for the canal's fifth section, 8 miles north of Corfu, Wash., is to include bifurcation structure, 3 county road bridges, 22 check structures, and 77 turnout structures.
Do	Construction of 34 miles of unlined area W-6B laterals, sublaterals, and wasteways having base width of 2 to 14 feet, varying from 90 to 2 cubic feet per second capacities on West canal near Quincy, Wash. Work also includes the construction of concrete structures, including division boxes, checks, weirs, culverts, and drops, and 2 pumping plants, 1 48 cubic feet per second and 1 41 cubic feet per second capacity.
Do	Construction of 13 miles of unlined drains in lateral areas E-2 and E-3, varying from 40 to 5 cubic feet per second capacities on East Low canal, near Moses Lake, Wash.
Do	Installation of supervisory control and telemetering equipment for the bifurcation works and Adco watermaster's office near Ephrata, Wash., will include construction of 4 small buildings and 0.5 mile of 2-wire line to serve as master control circuit.
Do	Installation of lighting standards, luminaires, and power and control circuits at entrances to powerhouses, along South Marina Way, and in Coulee Dam, Wash.
Do	Planting native grass on slopes in vicinity of Grand Coulee dam and switchyards, and landscaping at powerhouses, pumping plant, and switchyards.
Do	Furnishing and installing steel and aluminum handrailing and curbings for Grand Coulee pumping plant and bus runway, and right and left power plants at Coulee Dam, Wash.
Do	Installation of cooling equipment in Ephrata office building is to include furnishing and installing a 75-ton compressor, direct expansion coil, and associated equipment.
Davis Dam, Ariz.-Nev.	Interior painting of all metal work, structures, and equipment in Davis Dam, power plant, and switchyard.
Eden, Wyo	Construction of Prospect diversion dam and canal near Farson, Wyo., will require 225 feet of earth
Eden, Wyo.—Continued	dike, a rock weir 4 feet high and 70 feet long, and 2 miles of 75 cubic feet per second Prospect canal, including 2 concrete drop structures and a precast siphon. Contractor will also construct 0.4 mil of 5 cubic feet per second farm lateral, 2 precast siphons, and 1 farm bridge, and raise 2 other bridges.
Gila, Ariz	Construction of 22 miles of unreinforced concrete-lined laterals and sublaterals of 45 to 15 cubic feet per second capacities for unit 4 of Mohawk distribution system near Wellton, Ariz. Concrete structures include turn-outs, checks, drops, siphons, culverts, and lateral turn-outs. About 170,000 cubic yards of excavation for laterals is required.
Do	Construction of 2.4 miles of 220 cubic feet per second Dome canal and 2.6 miles of 100 cubic feet per second lateral D-1.4E, near Dome, Ariz. Structures on Dome canal will include river siphon, road siphon, radial gate check, 3 bridges, 2 constant-head orifice turnouts with capacities of 100 and 60 cubic feet per second, and 8 slope-type turnouts of 15 cubic feet per second capacities. The open distribution system will serve about 12,000 acres. Structures on lateral D-1.4E consist of 2 bridges and a pump lift.
Kendrick, Wyo	1 oil purifier, both centrifuge- and filter-press-type, of 600 gallons per hour capacity, and 1 filter paper drying oven for Alcova power plant.
Middle Rio Grande, N. Mex.	Construction of 22 miles of access roads to channelization work on the Rio Grande, and placing about 3 miles of gravel protection on levees, near San Marcial, N. Mex.
Missouri River Basin, Mont.	Missouri diversion dam to be constructed across the Missouri River near Wolf Point, Mont., is to comprise about 2 miles of earth dike and a gated concrete overflow section. Construction of Little Porcupine power plant which is to have a reinforced concrete substructure and a steel superstructure.
Do	Construction of basement for a house, placing foundations for a shop-garage, and moving and placing house and shop-garage on their foundations, including installation of necessary utilities, near Toston, Mont.
Missouri River Basin, Nebr.	Construction of 18 miles of unlined Cambridge canal's fourth section, including drains and channel changes with appurtenant reinforced concrete structures. Canal ranges in capacity from 12 to 30 cubic feet per second.

Construction and Materials for Which Bids Will Be Requested by June 1953—Con.

Project	Description of work or material
Missouri River Basin, Nebr.—Continued	Construction of 7 miles of unlined laterals varying from 12 to 6 cubic feet per second capacities, with appurtenant reinforced concrete structures for the second section of Cambridge canal near Oxford, Nebr., 32,000 cubic yards of lateral excavation.
Missouri River Basin, Nebr.-Kans.	Construction of 18 miles of unlined laterals varying from 12 to 6 cubic feet per second capacities, with appurtenant reinforced concrete structures for Franklin canal's first section, near Franklin, Nebr., 90,000 cubic yards of excavation.
Do	Construction of 11 miles of unlined Naponee canal, laterals, and drains varying from 36 to 6 cubic feet per second capacities, with appurtenant reinforced concrete structures, 12 miles west of Franklin, Nebr., on the south side of the Republican River beginning at Harlan County Dam. 200,000 cubic yards of excavation and about 8,000 feet of 18- to 28-inch diameter concrete pipe.
Missouri River Basin, Wyo.	Construction of 1,000-kva Meeteetse substation near Meeteetse, Wyo.
Palisades, Idaho	The Snake River bridge is to be a 3-span continuous deck plate girder bridge for Wyoming State Highway, U. S. 89, near the Idaho-Wyoming boundary. The end spans are 136 feet center to center of bearings and the center span 264 feet.
Do	12 turbine draft-tube bulkhead gates, lifting beam, seats, guides, and latches for Palisades power plant.
Rio Grande, N. Mex.	Construction of wasteway channels includes excavating and enlarging about 3 miles of wasteway channels on Picacho Arroyo system and construction of 3 concrete check-wash-drop structures and Picacho lateral check siphon, near Las Cruces, N. Mex.
Do	Furnishing material and stringing 2 galvanized steel overhead ground wires on 360 miles of existing 115-kilovolt transmission lines, and furnishing and stringing 3 397,500-centimeter ACSR conductors on 2 miles of line, all in New Mexico.
Shoshone, Wyo	Clearing and leveling about 500 acres of land at the old Heart Mountain camp site.
Yakima, Wash	The combined Chandler power and pumping plant structure to be constructed on the Yakima River, about 9 miles downstream from Prosser, Wash., will consist of a 12,000-kilowatt power plant to house 2 6,315-kilovolt-ampere generators, and a 500 cubic feet per second turbine-driven pumping plant to house an initial 2 and an ultimate 3 167 cubic feet per second units. The substructure and intermediate structure will be reinforced concrete and will have dimensions of 49 by 171 by 31 feet; the contractor-furnished superstructure to measure 39 by 140 by 38 feet will be of steel framing with insulated metal wall panels. The headworks consists of a gated iceway 20 by 3 feet; four siphon spillways discharging into a 1,500 cubic feet per second, 390-foot-long spillway chute; a 4-foot diameter sluice gate; a trash-rack structure at entrance to 2 120-inch power penstocks; and 3 87-inch pump supply lines. The contractor will construct a 3,500-foot-long, 99-inch-diameter, 250-foot head pump discharge line across the Yakima River to the Main canal; and furnish steel pipe or concrete pipe steel lined for 2,300 feet. He will install embedded parts of 2 85,000-horsepower and 2 2,600-horsepower government furnished turbines and a 40-ton bridge crane; and construct a railroad bridge and highway bridge.
Do	2 oil pressure, cabinet-type, gate shaft governors for regulating the speed of 2 8,500-horsepower hydraulic turbines for Chandler power plant.

United States Department of the Interior, Douglas McKay, Secretary
BUREAU OF RECLAMATION OFFICES AS OF MARCH 15, 1953

Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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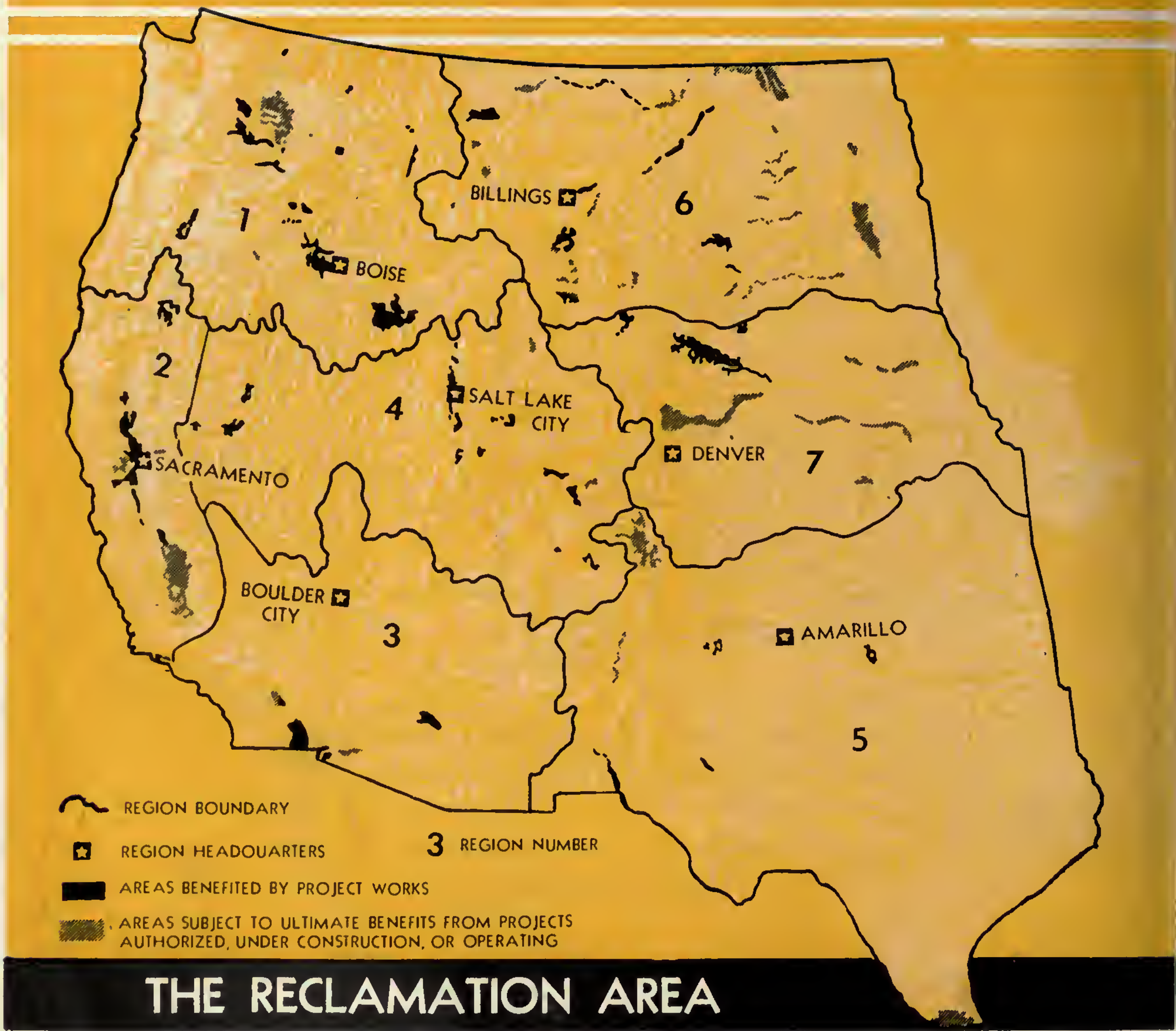
Water is Wealth

U. S. GOVERNMENT PRINTING OFFICE: 1953



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The *Reclamation* Era

Official Publication of the Bureau of Reclamation

May

1953

IN THIS ISSUE:

"SCABLANDS" In The Columbia Basin

Yuma's Canal Road Sprinklers

May 1953

Volume 39, No. 5

The Reclamation ERA

35 Years Ago In The Era

Making the Farm Pay

In making the farm pay the first essential is to have a farm which may be developed and put into condition to make it a profitable proposition. The successful farmer is the one who dominates the situation and manages his business along well-defined lines instead of permitting his business to proceed along haphazard lines. In irrigation farming the farmer controls all the essential factors of successful farming.

The first thing for a farmer to do is to plan a system of farming or what is commonly termed a crop rotation. Crop rotation is the means of good crops, it is the means of maintaining the fertility of the soil, and an even and economical distribution of the farm labor. A good rotation of crops will eradicate weed pests and minimize the danger of insect pests and crop sickness.

Plan your crops 3, 5, or 10 years in advance. Don't plan with the single idea of getting ahead of your neighbor; plan to improve your own condition.

Real business is not to get ahead of others; it is to get ahead of yourself.

(Excerpts from an article by I. D. O'Donnell, on page 203 of the May 1918 issue of the Reclamation Record, predecessor to the Reclamation Era.)

OUR FRONT COVER—INSPECTING ASPARAGUS SEED STOCK raised by Ray Young from seed, near Quincy, is John L. Toevs, Chief of Land Development Branch on the Columbia Basin project in Washington State. The 4 acres of seed stock were transplanted over 70 acres this spring. *Photo by F. B. Pomeroy, Region 1.*

OUR BACK COVER is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners Kittredge and Coolidge.

DESIGN AND ILLUSTRATIONS by Graphics Section, Bureau of Reclamation, Washington, D. C.

J. J. McCarthy, Acting Editor

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In this issue . . .

RECLAMATION PLACE NAMES IN THIS ISSUE

PETRIFIED WOOD examined by Dr. J Harlen Bretz, left, and Reclamation geologist W. E. Walcott. At right, "New Water," flows down a channel part of Potholes East Canal. The view is called Soda Lake. Photos by H. E. Foss, Region 1.

"SCABLANDS" IN THE COLUMBIA BASIN

by RAY J. SCHRICK
Columbia Basin Project
Ephrata, Washington, Region 1

DR. J HARLEN BRETZ, professor emeritus of geology at the University of Chicago and one of the world's foremost geologists, recently returned to the Columbia Basin for approximately 3 weeks to resume field work on his theory of the origin of the scablands in central Washington.

One reason for Dr. Bretz' return after an absence of more than 2 decades, was the uncovering of new geologic evidence in the digging of canals, tunnels, and borrow pits in the course of building the Bureau of Reclamation's Columbia Basin project.

He declared after his initial 5 days in the field, that the new evidence he had seen "proved conclusively" the truth of statements he first conceived almost 30 years ago, when the irrigation dream in the Columbia Basin was only an embryonic idea.

Dr. Bretz started his field work in the basin in 1922, the same year that Maj. Gen. George W. Goethals, builder of the Panama Canal, was brought in to investigate means of irrigating the basin territory.

Dr. Bretz left the basin after 7 years of field work in 1929, and his last published work, a book entitled "The Grand Coulee," appeared in 1932.

His theory is that an enormous flood, perhaps the largest in the world, made the scablands of eastern Washington in a period of perhaps a few days. The theory has been a source of argument in geologic circles for the past 2 decades.

Glacial waters were dammed 2,200 feet deep in glacial Lake Missoula, part of which is now Pend Oreille Lake, according to the geoligist. The noted Cordilleran Ice sheet, lying between the Rockies and Cascades in Canada dammed the giant waterway near the head of what is today the Clark Fork River.

The glacial Lake, according to Dr. Bretz, contained about 500 cubic miles of water at its maximum, and its surface level then was 4,200 feet above sea level.

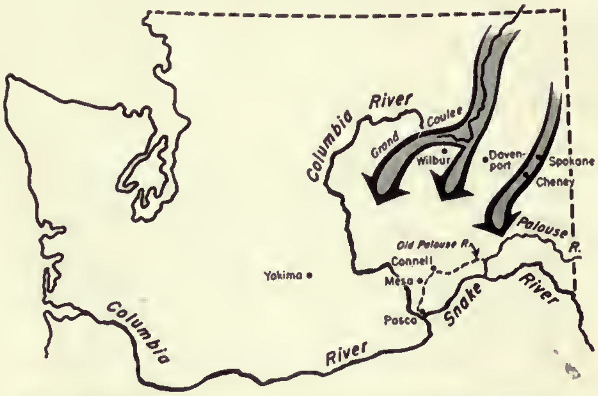
By far the greater quantity of this water was released suddenly, and in the crashing of the flood, an area almost twice as large as the state of Delaware was washed virtually clean of productive soil, leaving only the barren rock.

This volume of water would be sufficient to cover the state of Texas to a depth in excess of 5 feet.

Dr. Bretz worked closely with the Geology Branch of the Columbia Basin project during his 2 weeks of field work in the basin this trip, having the assistance of W. E. Walcott, district geologist for the Bureau of Reclamation with headquarters in Ephrata. Dr. Bretz also was joined by a co-worker from Kansas, Prof. Harold T. U. Smith.

Among the cases of new evidence in support of his theory, cited by Dr. Bretz were gravel pits in the vicinity of Moses Lake. Here, in the area where new settlers are seeking their wealth through irrigating rich topsoil untouched by the runoff, Dr. Bretz found vast stores of "unsorted gravel," which evidently had been pushed headlong by a huge volume of water.

"Some of my opponents say 'less water and more time'," the noted geologist declared. "But a small volume of water couldn't have moved that mountain of material and boulders and gravel, even given a billion years, and left it the way I found it there.



"Granite boulders up to 15-feet maximum di ameter were transported from the head of th Grand Coulee by this torrent to a point as fa south as half way between Ephrata and Mose Lake, more than 50 miles away."

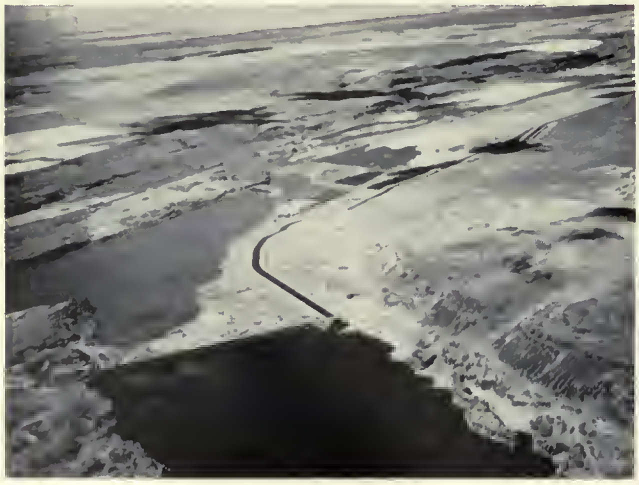
Dr. Bretz believes that the cascading flood o glacial Lake Missoula entered the 12,000 squar mile area on a 100-mile front reaching fro Cheney west to Grand Coulee from the Nortl cutting and enlarging three major valleys. On was the Grand Coulee (see map on this page which man has utilized anew to put waters o the sagebrush lands of the Columbia Basin proj ect, ultimately planned to reclaim more than million acres.

A second compound channel runs south betwee Davenport and Wilbur, Wash.; the third chann extended south across the present site of Spokan by Cheney, Wash., to the Snake River.

He believes that the Palouse River, which too the Spokane, Cheney flood runoff, once flowe along Washtucna Coulee past Connell and Mes along the southeasterly boundaries of the Colum bia Basin project, and south down Esquatz Coulee, discharging into the Columbia Rive canyon near Pasco.

He believes the glacial flood by its very volum cut the present Palouse Canyon across th preglacial divide between the Snake and the ol Palouse. Water and ice-rafted boulders we backed up the Snake River as far as Lewisto Idaho, more than 100 miles upstream.

LONG LAKE DAM, lower left, aerial view. Ancient scablands **left, partly covered by new Reclamation reservoir. Main Can takes off from right center. Below, aerial view looking nor from Long Lake Reservoir, foreground; across 165-ft. Long La waterfall in Main Canal.** ***Photos by F. B. Pomeroy, Region***



The tremendous erosion by this flood of glacial water cut potholes in basalt rock up to 100 feet deep, left gravel bars 200 feet thick, and receded, leaving dry cataracts, the most famous of which, Dry Falls, is about 5 times the height of Niagara Falls and 7 times as wide.

The eastern Washington wheatland area, which makes the State the fifth greatest wheat producing State in the Nation (1950 figures), was greatly reduced in its potential by the flood which removed the rich topsoil, or loess, leaving only the barren, unproductive rock, which in places has a shallow top covering suitable for light grazing.

A total of 2,800 square miles was scoured clean. An additional 900 square miles are buried by gravel and sand.

The 1,029,000 irrigable acres of Columbia Basin project, with its 4,500 miles of canals and laterals, are being developed by the Bureau of Reclamation among the soils left largely untouched. In fact, some of them were built up as a result of the discharge.

Dr. Bretz is a former University of Washington professor. He did not start his field work on the origin of scablands until he moved to the University of Chicago.

THE BIG SPLASH—Look at Long Lake drop. Main Canal pours into reservoir behind Long Lake Dam. ***Photo by F. B. Pomeroy, Region 1.***

"It's an epic story you have here on the Columbia Plateau," Dr. Bretz said. ###

New Members of the Interior Secretariat

Colonel Ralph A. Tudor, Under Secretary, former Governor Fred G. Aandahl of North Dakota, Assistant Secretary——Water and Power, and Mr. Orme Lewis of Phoenix, Ariz., Assistant Secretary are the new top ranking aides to Secretary of the Interior McKay.

Governor Aandahl became Assistant Secretary—Water and Power on February 10. In this capacity he exercises supervision over the Bureau of Reclamation; Bonneville Power Administration; Southwestern Power Administration; and Southeastern Power Administration. Pending the apppointment of Commissioner for the Bureau of Reclamation, Governor Aandahl was designated by Secretary McKay to act as Commissioner.

He was born in Litchville, N. Dak., in 1897, and is a graduate of the University of North Dakota. He served three terms as Governor, and was a member of the 82d Congress in 1951–52.

Assistant Secretary Lewis assumed his new duties February 20. He was born in Phoenix, Ariz., in 1902, and is a graduate of George Washington University, Washington, D. C., where he received his LL.B degree in 1926. He has practiced law for a number of years, primarily engaged in the field of business and corporate law particularly with relation to irrigation and other western problems. Secretary Lewis has charge of the public land management programs of the Department and directly related activities.

Under Secretary Tudor was born in Colorado Springs, Colo. in 1902. He is a graduate of the United States Military Academy at West Point where he received his B. S. Degree. He did postgraduate work at Cornell University, specializing in hydraulics and earned a degree in Civil Engineering in 18 months.

Colonel Tudor is highly regarded in engineering circles, having worked for the Corps of Engineers, the California Division of Highways as well as serving in the capacity of Vice President for the Morrison-Knudsen International Company.

Some of the highlights of his career include preparation of basic plans for McNary and the Dalles Dams; Chief Engineer on studies for highway crossing of the San Francisco Bay; consultant on a San Francisco Bay Bridge between San Rafael and Richmond and Chief Engineer in charge of plans for rehabilitation of roads, waterways and ports in China.

Colonel Tudor took office on March 31.

Mr. Felix E. Wormser of New York was nominated Assistant Secretary for Minerals by President Eisenhower as this issue went to press.

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LONG DISTANCE ROAD SPRINKLING is much more efficient with this type of equipment. ***Photo by Maurice N. Longley, Region***

YUMA'S CANAL ROAD SPRINKLERS

Members of the Yuma County Water Users Association on the Valley Division of the Yuma project in Arizona have solved one of the problems of keeping their canal roads in good shape.

During the summer months of 1950 the operating roads along the Valley Division became so dry and dusty that it was very expensive and time-consuming to maintain them properly with ordinary maintenance equipment. It was apparent that, if operating roads could be thoroughly wetted, motor graders could then smooth the surface and fill the ruts and chuckholes with wet material. At that time the Bureau of Reclamation had four sprinkler trucks in operation. If they had no interruptions or breakdowns, each truck could apply 8 to 10 loads of approximately 1,000 gallons each, to operating roads in an 8-hour day.

The roads were so dry that it was necessary to make 4 or 5 applications with sprinkler trucks on each section of road before it was sufficiently saturated to blade. The cost of operating the sprinkler trucks was about $3.00 per hour each, plus the cost of drivers. This was so prohibitive that t sprinkling was discontinued. As a result, the o erating roads became so rough that it was diffic to keep radio pickup trucks in mechanical or el trical repair. Finally, in November 1950, Willia L. McCaig, Head of the Maintenance Section the Bureau asked Mr. John L. Williams, the Mai tenance Superintendent in charge of equipme to develop a sprinkler which would pump wat directly from the canals onto the roads through spraybar.

After some experimentation and with the sistance of Bureau shop foreman Charles F Williams mounted a 4-inch pump on a trailer wi a side boom from which a suction line could suspended and dragged in the canal. This 4-in pump can lift approximately 40,000 gallons water per hour out of the canal onto operati road surface. By blading a ridge of dirt alo both sides of the operating road ahead of t sprinkler pump, the water can be ponded on t road surface and allowed to sink in. Thus, it obvious that considerably more water can be applied with the pump unit in an hour than the four trucks had been able to apply in a day.

Mr. Williams, who designed the earlier model of the sprinkler rig described above, went to work for the Water Users Association. In this new capacity he supervised the construction of a similar water wagon which is now used by the Association. According to Mr. Harry S. Riddell, the present project manager, Jose Munoz and Francis Baker, machinist and welder did most of the construction work on the machine.

The equipment consists of a 4-inch self-priming water pump mounted on a two-wheel trailer, with a derrick and boom to operate the suction hose. There is a 16-foot aluminum pipe for intake from which about 4 feet of rubber hose hangs into the canal. This has an elbow in it which holds the hose straight. The pump discharges into a 4-inch T manifold and there are 4 homemade nozzles that are spaced across the 4-inch pipe. There is a piece of aluminum tubing on which the boom is mounted set on a ball bearing so that the boom can be swiveled to either side of the canal. This boom can be dismounted for road traveling. The 16-foot suction pipe is controlled by a hand operated handle on a cable drum mounted on the side of the stand which supports the boom and the derrick.

In the Bureau's work it was found that it was not practical to use the tractor-drawn trailer in areas which were some distance away from headquarters. Either the equipment had to be loaded onto a large tractor trailer unit or considerable time was wasted on the road. To solve this problem one of the rusted-out tanks was removed from one of the old sprinkler trucks and a 4-inch pump was mounted directly on the truck chassis and equipped with a side boom and spray bar similar to the one used on the trailer. This equipment is now being used to wet down operating roads along canals and on all projects operated by the Bureau in the Lower Colorado River District. Operation, maintenance, and depreciation of this unit costs about $3.00 per hour plus the truck driver and laborers (at the present time drivers are paid $1.50 and laborers $1.35 per hour). This unit can cover from 2 to 4 miles of road per hour, depending upon the amount of water it is desired to apply. Very little time is lost getting around structures since the laborer merely winds up a windlass and lifts the suction line up to the side boom to pass over the structure. Once past the structure, the suction line is lowered and the self-priming pump immediately picks up a new prime and starts operating.

FOR LOCAL SPRINKLING use tractor trailer rig. *Photo by Clarence Barsuk, Yuma County Water Users Association.*

At present prices the total cost of the entire pump and spray unit, assembled and ready to set on a truck chassis ranges from $1,200 to $1,500.

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MAN-MADE Garden Spot in lush 356,000-acre Boise project. Black Canyon canal is in foreground. *Photo by Phil Merritt, Region 1.*

The Crops of CANYON COUNTY

by FLORENCE M. STEWART
County Home Demonstration Agent
Canyon County, Caldwell Idaho

Canyon County in Southwest Idaho in the heart of the Boise project is truly a garden spot. It is a part of the Boise Valley which is irrigated from storage in the Arrowrock and the Anderson Ranch Dams. The Lucky Peak Dam, now under construction for flood control, will furnish a supplemental supply of water if needed.

Land is so productive in this area that you have to see it to believe it. In 1950, a 4–H Club girl raised 44 tons of beets per acre on her 3-acre project. The county average taken from the 1950 census showed an average of 22.74 tons per acre from 15,597 acres, some of which has been under irrigation but a few years. Her 3 acres were free from alkali, and had been heavily manured. For years it had been a part of a 14-acre pasture. The other 11 acres of the same field yielded 36 tons per acre the same year.

Three cuttings of alfalfa (and sometimes more) are the usual thing. Farmers start cutting ha[y] before you hardly know that spring is here. Sta[tistics] show that the average for the county is [a] strong 3.8 tons per acre from 38,832 acres. See[d] crops are high; 1,727 acres produced 235.6 poun[ds] of seed per acre. Farmers produced 308.5 poun[ds] of red clover seed per acre from 6,642 acres to sa[y] nothing of the clover and alfalfa honey produce[d].

Garden seed, including popcorn, is a big cro[p]. Onion seed fields are beautiful with their tall gree[n] tops, capped with a big white ball filled with see[d]. In July, August, and September last year (1952) forty-nine railroad cars of seed were shipped fro[m] Caldwell alone. This does not include seed sol[d] or stored locally, nor any that was trucked [or] otherwise shipped from other towns. Seed cro[ps] shipped were: onion, carrot, peas, and corn. I[n] this same period 372 cars of potatoes, 23 cars [of] fresh vegetables and 86 cars of fruit were shippe[d] by rail. From October 1951 to March 1952, in[clusive], 195 cars of seed were shipped fro[m] Caldwell alone.

Vegetable growers in this county have almo[st] one-third of the acreage in the State, and recei[ve] over 46 percent of the income from vegetabl[es] sold. The chief crops grown are onions, potatoe[s], sweet corn, beans, peas, lettuce, and carrots. Th[e] income from 6,439 acres was $1,556,221.00 in 1950, an average of approximately $242 per acre.

Fruits are raised in abundance in some sections of the county, also. Predominating tree fruits are prunes, apples, peaches, cherries (sour and sweet), and apricots. The yield of each runs into hundreds of thousands of bushels. Prunes lead production with 325,934 bushels. Sweet cherries yielded 777,536 pounds according to the 1950 census. In late summer, after the fruit has been thinned, farmers use props to prevent fruit laden limbs from breaking down. After harvest, the props, stacked to look like tepees, resemble an Indian Village.

Strawberries, blackberries, dewberries, raspberries, boysenberries, loganberries, and youngberries grow abundantly. Strawberry production leads with 969 quarts per acre from 56 acres.

Small fruit farmers supply the berries and the dairymen pour on the cream. With 26,200 cows in Canyon County, 25,600 in Ada County, and 3,900 in a small portion of Owyhee County—just across the Snake River—this section of Idaho, known as the Boise Valley, had a butterfat production of 44 million pounds in 1951. The dairy industry ranks first in income with the receipts from sales of dairy products amounting to $11,805,875.00. Cows in this area are not the "old brindle" type by any means. Farmers are in the dairy business for high production, and at the same time they have in mind crop rotation and soil building. The old barrel churn was relegated to the attic about the time old brindle died.

Several dairy products are processed in one way or another here at home. There are 4 Grade A plants, and 4 manufacturing plants. In 1951 dairy sales included 3,520,000 pounds of butter, 2,038,000 pounds of butterfat sold in products other than butter, and 9,000,000 pounds of skim milk powder. A large plant in Nampa cans evaporated milk. Ice cream, anhydrous milk fat, skim and whole milk powder, condensed milk, cottage cheese, and grade A milk are other products of the valley.

Quantities of fruit and vegetables, also, are processed in the county. Potatoes and onions are dehydrated. Other vegetables and fruits, some of which are corn, asparagus, cherries, and prunes, are canned or frozen on a commercial scale.

How is all this production possible? Because the water has come! Our forefathers had a vision backed by scientific "know how." Dams have been, and are being, built in the foothills and in the mountains to catch the runoff. This water storage is released when and where it can best be utilized. Some of the fields are watered by gravity flow from storage reservoirs and some by pump irrigation. On certain terrain and some types of soil the sprinkler system is used.

Farmers utilize fertilizer and water; they destroy weeds and insect pests; they rotate crops; they select good seed; they work long hours. It is not all a bed of roses, but they "keep on keeping on" and are happy in doing it. With the lifesaving water, their land continues to produce. The goal is nearing—some of the comforts of life. and their own homes, for their families. ###

HEALTHY GUERNSEYS help to balance crop production and provide profitable employment throughout year. *Photo by Stan Rasmussen. Region 1.*

NITROGEN AIDS COTTON CROP under irrigation at Brawley, Calif. One hundred sixty pounds of nitrogen increased the yield by 0.8 bale per acre. *All photos courtesy of BPI, Department of Agriculture.*

NITROGEN IN THE WEST

PART 2—NITROGEN AND YOUR DOLLAR

How Nitrogen Fertilizer Increases Yields

by OMER J. KELLEY, Principal Soil Scientist
Division of Soil Management and Irrigation
United States Department of Agriculture

Research men throughout the West report markedly increased yields of nonlegume crops through the use of nitrogen. These increases usually are lower on dry land than on irrigated lands because of lack of moisture.

Here are a few data from nitrogen trials on irrigated lands showing the value of nitrogen in increasing yields. On depleted soils at Scottsbluff, Nebr., corn yields were increased from 40 bushels per acre to 120 bushels per acre by applying 120 pounds of nitrogen per acre. Experiments with sugar beets in Utah resulted in yield increases averaging 6 tons per acre from 160 pounds of nitrogen. At Brawley, Calif., where the control plot with no nitrogen yielded 2.45 bales or an increase of 0.8 bale per acre, an addition of 160 pounds of nitrogen gave a yield of 3.25 bales or an increase of 0.8 bale per acre. At Tucumcari, N. Mex., grain sorghum yields were increased 40 bushels per acre with 120 pounds of nitrogen. In Colorado and Wyoming 160 pounds of nitrogen increased yields of Mountain Meadow hay by as much as 2.5 tons per acre. Many more equally striking benefits could be quoted.

Various Factors Influence Nitrogen Efficiency

Many things influence the magnitude of crop response that can be expected from the use of nitrogen fertilizer. Two of the important things to know are how much manure was applied previously, and how much alfalfa was grown in the rotation. Then, too, some crops require more nitrogen than others. But there are several factors that will influence how much a given crop on a given piece of land will respond to nitrogen. As a matter of fact experiments show that the manner in which a crop responds to nitrogen depends upon almost any thing that will affect plant growth: thickness of planting, the soil moisture conditions, time and way the nitrogen is applied; the method of irrigation, and the amount of other fertilizer elements applied.

A corn experiment in the Columbia Basin demonstrates how irrigation frequency influences nitrogen response. In this experiment two irrigation treatments were set up. In the drier treatment, 3 irrigations were made or a total of 1[illegible] inches of water was applied. In the wetter treatment, 8 irrigations, or a total of 24 inches, was applied. When 240 pounds of nitrogen was applied, the corn yield was increased 79 bushels on the wet treatment, and only 35 bushels on the dr[illegible]

RESULTS SPEAK for themselves.

WITHOUT NITROGEN—With nitrogen.

treatment. For the dry treatment, 80 pounds of nitrogen gave maximum yields; on the wet treatment the yield increased up to 240 pounds, with about 160 pounds of nitrogen being the most economic rate.

Other experiments have shown that the time of applying nitrogen on corn is not so important—if (and this is a big "if") there is enough nitrogen in the soil to meet the maximum requirement of the plant. In the case of corn, this "maximum requirement" occurs during the period when the plant is starting to approach maturity—from a little before tasseling on. Also, some corn hybrids may do best under an intermediate level of nitrogen while others give maximum performance under high levels of nitrogen. The same appears to hold for different varieties of barley.

You will be interested in knowing that nitrogen applied during 1 year will carry over into the next. Usually the largest amounts applied give the greatest residual responses. For example, in North Dakota 120 pounds of nitrogen applied on corn in 1950 increased the yield of the 1951 barley crop by 27 bushels. Of course, on extremely sandy soils any extra nitrogen may be leached out of the root zone. In fact, on irrigated sands it is often desirable to split the nitrogen application and to apply it at intervals during the season. This assures keeping a nitrogen supply within reach of the plant roots throughout the growing season.

Nitrogen Affects Quality

Nitrogen affects the quality as well as the quantity of plant material produced. In Colorado and Wyoming, the protein content of Mountain Meadow hays has been increased greatly when nitrogen fertilizers have been combined with proper irrigation. In nearly all cases nitrogen fertilizers increase the protein content of dryland wheat regardless of whether or not they increase the yield. In the Columbia Basin in Washington the protein content of corn has been markedly increased by adding nitrogen fertilizers.

Too much nitrogen fertilizer sometimes has a bad effect on the crop. With sugar beets, it is easy to reduce the percentage of sugar to the point where the favorable effect of nitrogen on increased tonnage is partly or fully nullified. As a rule, intermediate amounts of nitrogen will increase beet yields without seriously reducing the sugar content. Also, too much nitrogen on small grains may damage the stand of the new seeding. In other instances, small grains may lodge.

All Problems Not Answered

While we know a lot about the use of nitrogen fertilizers, there is still a lot more to learn. We need to be able to predict just how much nitrogen should be applied for a given crop on a given field. This involves knowing how much nitrogen will be available in the soil in order that we can figure how much extra nitrogen we must apply. We need to develop sound soil tests to help determine this. We need to know what happens to the nitrogen when it is applied to the soil. What about the addition of nitrogen to irrigation water? Very little scientific information is available. For instance, on calcareous soils of the Southwest we suspect that ammonia forms of nitrogen are dissipated into the air, but we aren't sure. Insofar

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EARLY DAYS ON THE SALT RIVER PROJECT

by OLIVER T. REEDY, M. ASCE
Consulting Civil Engineer (retired) Denver, Colorado

THE WHOLE STORY OF RECLAMATION in Arizona is interesting, but to me that which deals with the early days of the Salt River project is absorbing. I was there.

Shortly after President Theodore Roosevelt signed the Reclamation Act on June 17, 1902, I became the 20th engineering appointee in the Reclamation Service on October 17, 1902.

If it had not been for slow mail service, I might have been among the first dozen engineers appointed to the Reclamation Service.

The offer of an appointment as assistant engineer from Morris Bien, assistant head of the Reclamation Service, caught up with me while I was on reconnaissance work for the Mexican Central Railway in the wild mountains between Tampico and Mexico City. Our mail was always several weeks in reaching us.

Early in November 1902, I reported for work in Phoenix. On November 6th I set up an engineer's level on a Mesa street, and starting from a bench mark in front of the Alhambra Hot[illegible] began a line of levels to control such stadia su[illegible] veys in the Salt River Valley.

Chief Engineer Frederick H. Newell, head [illegible] the Reclamation Service, had prints made of [illegible] contour map of the township in which Mesa [illegible] located and sent them out to other projects as [illegible] sample of the work required. Among other ma[illegible] made by my field party were Lehi, Camelba[illegible] and Glendale townships. Late in 1903 I was se[illegible] up to Livingstone to make plane table surveys f[illegible] the Power Canal which was built to supply pow[illegible] for operating the cement mill and other machi[illegible] ery in building Roosevelt Dam. Shortly the[illegible] after I succeeded the engineer in charge of ca[illegible] surveys. When they were completed, the job[illegible] final location and construction of the Upper S[illegible] tion, including the Diversion Dam and Inta[illegible] was assigned to me.

The Upper Section of the Power Canal w[illegible] about 11 miles long, consisting of open excavati[illegible]

by horses and scrapers, 12 tunnels in all stages of construction, concrete drainage structures, a bridge or two, the Intake structure and Diversion Dam, and what I believe to be the first reinforced concrete pressure-pipe built by the Reclamation Service—the Pinto Creek Siphon. I was in the saddle most of the time on inspection, and my

A FAR CRY from modern construction camps was the damsite camp at Livingstone, Ariz., shown in above photo taken in 1904. Note 6-mule heavy freight wagon and trailer, with pack outfit in the rear, right foreground. Wagon and trailer were used especially to haul provisions from Globe, 40 miles distant. Horse and scraper action in lower left photo. Mr. Oliver T. Reedy at plane-table with alidade is at right. *All photographs courtesy of author.*

bride (we were married in Stromsburg, Nebr., on September 20, 1904) tagged along astride her cow-pony Captain, wearing her cartridge belt and pearl-handled Colt six-shooter.

I have only one picture showing actual work by horse and scraper. It is far from representative of the magnitude of the work. Most of the time there were several hundred teams of horses on the job. This picture does show an interesting aspect of early construction. Most of us younger fellows were somewhat green on that class of work, and in selecting the canal cross-section our designer used the one which gave the maximum discharge with minimum excavation, without taking into account methods and details of construction. This called for a narrow base, deep flow and steep side slopes. It resulted in creating the problem of getting the teams in and out of the ditch, and turning them around in a deep cut with a bottom width of 8 feet.

The picture shows comparatively easy digging. On some portions it was necessary to use a heavy rooter plow handled by 2 men and pulled by a 6 horse team. This made an outfit at least 35 feet long. They were guided with a jerk-line and oral directions, principally the latter.

The complete structure was not built until after I left the project in 1906 to do some townsiting for a brother-in-law in Nebraska, and when I returned to the Service I was assigned to another project. But Arizona remained a fond memory, and in February and March 1951, my wife and I spent several weeks in Mesa and Phoenix, recalling some of those cherished experiences of almost half a century ago. We took a trip to the canal and headworks, but before leaving for the Intake Dam and Canal, I visited the Water Users Association offices, where I was most cordially received as an old-timer and given maps and useful information. I asked the Superintendent if it would be difficult to find the abandoned canal. I assumed it had been abandoned when water from the Reservoir was turned into the penstock. He replied, "Abandoned? It's been abandoned several times and always brought back into service. Just now it's a Godsend while the reservoir is drained for repairs. It is the source of all the power we have up there." I was surprised and pleased.

I feel very gratified over having been associated with the beginnings of the Salt River project and other early activities of so magnificent an organization as the Bureau of Reclamation. ###

Nitrogen

Continued from page 97

as adding nitrogen to water and applying by flood or furrow irrigation method is concerned, where such losses are not a problem, the nitrogen should be distributed in the same manner as the water. If good distribution is obtained, the method should be as efficient as applying the solid form. However, care should be taken to avoid excess leaching. Furthermore, we know very little about the nitrogen needs of a series of crops when grown in rotation. What is the nitrogen balance? How much nitrogen do legumes provide, how much do we get from manure, and how much do we have to add? Can we spray liquid nitrogen profitably on dryland wheat with airplanes? These are just a few of the problems still facing us. ###

How To Apply Nitrogen

by VANCE T. SMITH, Soils Specialist, University of Idaho Extension Service

Side dress or broadcast. It doesn't make much difference how you get nitrogen on beets and potatoes. Results at the Aberdeen branch experiment station, University of Idaho, have indicated that equal results are obtained either way. This means that nitrogen can be applied with whatever equipment you have. I might give one word of caution about the broadcast method, and that is for best results the nitrogen should be placed in the soil rather than on it. I realize that when you broadcast a fertilizer it goes on the surface. What I mean is that it should be worked in either by plowing or fairly deep disking.

When it comes to the practical use of fertilizers, a time must be chosen for doing the job. A beet sugar company is recommending that fertilizer be applied in the fall prior to fall plowing. It advocates fall plowing for beets and urges that the fertilizer be placed on the field before plowing. In our relatively low rainfall areas I endorse these recommendations. However, in areas of high rainfall where soluble fertilizers like nitrogen could be moved below root depth with heavy precipitation, I would wait and apply it on the field during seedbed preparation in the spring. #

Thanks To The Tribune

EDITOR'S NOTE: *We wish to extend our appreciation to the Salt Lake Tribune for the excellent portrait of Mr. William R. Wallace which appeared in the "Hall of Fame" article in the March 1953 issue of the Reclamation Era.*

WATER REPORT

OUTLOOK FOR 1953 WATER SUPPLY OF THE WEST

by R. A. WORK, Senior Irrigation Engineer, and CLYDE E. HOUSTON, Irrigation Engineer, both of the Soil Conservation Service, United States Department of Agriculture

Irrigations farmers, public and private power utilities, and all other water users in Western States are now receiving the most accurate and comprehensive information to be had on prospective water supplies through a recently coordinated forecasting program by the several agencies involved.

Under this new cooperative arrangement, which became effective January 1, 1953, the United States Weather Bureau, United States Soil Conservation Service, and California Department of Public Works continue to issue their respective water supply forecast and snow-survey water forecast publications after prior collaboration among the respective agencies.[1] The Weather Bureau's "Water Supply Forecasts for the Western United States" published monthly from January through May, now contains all of the forecasts made by all three agencies.

Coordinated early season evaluation of potential flood hazard on snowmelt rivers, which are presented in the respective publications in years of heavy snow cover, draw upon both snow-survey and precipitation data. Weather Bureau river district offices will continue to prepare and issue short range forecasts of river stages. The Soil Conservation Service will continue to make available to Soil Conservation District farmers, irrigation districts and others, operational advice based on these outlooks and forecasts.

SNOW MELT which will provide water irrigation for parched acres this summer. ***Photo by Robert Bronstead, Soil Conservation Service, United States Department of Agriculture.***

The water supply outlook for Western States for the irrigation season now underway as viewed by these agencies, is much less promising than last season. Threatening water shortages are foreseen for numerous areas, particularly in New Mexico, southern Utah, southern and central Nevada, and parts of Arizona and Colorado. The following State-by-State inventory gives a more detailed accounting of irrigation season runoff prospects, as reported to the Soil Conservation Service by the snow surveys.

ARIZONA—Only two major winter storms three months apart covered Arizona last winter. These two big storms brought about normal rainfall for the period October–March to southern Arizona but only 72 percent of the seasonal normal to northern Arizona. Snow cover has been below normal most of the winter. Above normal winter temperatures and heavy evaporation losses further reduced the northern Arizona snow pack. Because of snow pack losses, and total deficiency of snow cover it is forecast that flow of the Salt River will equal only 50 percent normal for April–May. Flow of the Verde River for the same period is not expected to exceed 35

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[1] The Soil Conservation Service is the Federal Coordinating agency of snow surveys conducted by its staff and many cooperators, including the Bureau of Reclamation, Forest Service, National Park Service, Geological Survey, various departments of the several Western States, irrigation districts, power companies, and others. The California State Division of Water Resources conducts and coordinates snow surveys in that State, while the British Columbia Department of Lands and Forests, Water Rights Branch, has charge of the snow surveys in that province. The U. S. Weather Bureau makes westwide water supply forecasts at more than 320 gaging stations, such forecasts being estimated principally on the basis of measurement of precipitation. The Weather Bureau forecasts are for the water year (October–September, inclusive) whereas, snow survey forecasts are always for the irrigation season only.

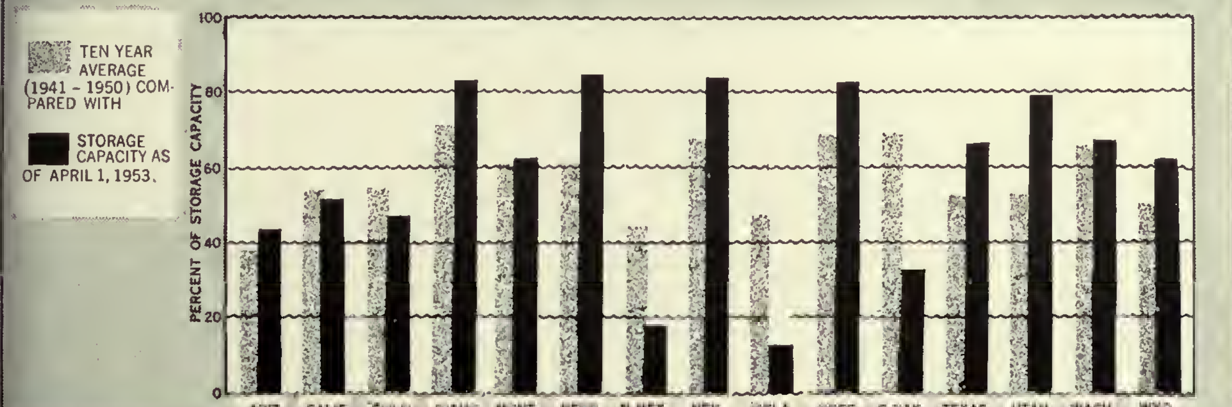
Water Stored in Reclamation Reservoirs

Location	Project	Reservoir	Storage (in acre-feet) Active capacity[1]	Mar. 31, 1952	Mar. 31, 1953
Region 1	Baker	Thief Valley	17, 400	(2)	(2)
	Bitter Root	Lake Como	34, 800	13, 600	5, 60
	Boise	Anderson Ranch	464, 200	70, 300	255, 10
		Arrowrock	286, 500	19, 600	231, 20
		Cascade	650, 000	110, 800	98, 80
		Deadwood	161, 900	31, 900	68, 61
		Lake Lowell	169, 000	148, 200	162, 00
	Burnt River	Unity	24, 600	7, 200	15, 10
	Columbia Basin	F. D. Roosevelt	5, 220, 000	1, 070, 000	2, 183, 03
	Deschutes	Crane Prairie	50, 000	47, 000	50, 00
		Wickup	182, 000	177, 000	199, 00
	Minidoka	American Falls	1, 700, 000	1, 392, 200	1, 658, 20
		Jackson Lake	847, 000	520, 000	441, 90
		Lake Walcott	95, 200	89, 000	93, 2
		Grassy Lake	15, 200	13, 200	12, 8
		Island Park	127, 300	74, 800	102, 5
	Okanogan	Conconully	13, 200	8, 400	8, 3
		Salmon Lake	10, 500	10, 100	9, 7
	Owyhee	Owyhee	715, 000	531, 200	574, 4
	Umatilla	Cold Springs	50, 000	49, 600	44, 2
		McKay	73, 800	44, 600	65, 3
	Vale	Agency Valley	60, 000	38, 700	46, 6
		Warm Springs	191, 000	90, 000	165, 0
	Yakima	Bumping Lake	33, 800	4, 800	14, 7
		Cle Elum	435, 700	258, 900	240, 1
		Kachess	239, 000	184, 300	170, 5
		Keechelus	153, 000	86, 100	121, 5
		Tieton	197, 000	123, 100	133, 2
Region 2	Central Valley	Millerton Lake	500, 000	247, 800	292, 9
		Shasta	4, 366, 800	3, 849, 200	3, 621, 8
	Klamath	Clear Lake	513, 300	156, 800	280, 6
		Gerber	94, 300	26, 200	77, 1
		Upper Klamath Lake	524, 800	323, 500	443, 9
	Orland	East Park	50, 600	48, 500	50, 4
		Stony Gorge	50, 000	48, 900	51, 6
Region 3	Boulder Canyon	Lake Mead	27, 207, 000	15, 691, 000	17, 764, 0
	Davis Dam	Lake Mohave	1, 809, 800	1, 586, 500	1, 639, 0
	Parker Dam Power	Havasu	688, 000	600, 900	618, 5
	Salt River	Bartlett	179, 500	156, 000	48, 0
		Horse Mesa	245, 000	233, 000	236, 0
		Horseshoe	144, 000	118, 000	1, 0
		Mormon Flat	57, 800	52, 000	52, 0
		Roosevelt	1, 381, 600	682, 000	1, 049, 0
		Stewart Mountain	69, 800	50, 000	51, 0
Region 4	Fruit Growers	Fruit Growers	4, 500	300	4, 6
	Humbolt	Rye Patch	179, 000	114, 700	150, 0
	Hyrum	Hyrum	15, 300	10, 400	15, 7
	Mancos	Jackson Gulch	0, 800	800	3, 9
	Moon Lake	Midview	5, 800	4, 500	5, 0
		Moon Lake	35, 800	22, 700	21, 1
	Newlands	Lahontan	290, 900	140, 400	273, 2
		Lake Tahoe	732, 000	504, 000	552, 0
	Newton	Newton	5, 400	3, 500	5, 3
	Ogden River	Pine View	44, 200	3, 200	19, 5
	Pine River	Vallecito	126, 300	26, 600	56, 3
	Provo River	Deer Creek	149, 700	108, 700	116, 7
	Scofield	Scofield	65, 800	33, 800	50, 4
	Strawberry Valley	Strawberry	270, 000	153, 300	249, 8
	Truckee River Storage	Boca	40, 900	2, 700	6, 2
	Uncompahgre	Taylor Park	106, 200	55, 500	64, 1
	Weber River	Echo	73, 900	13, 300	46, 8
Region 5	W. C. Austin	Altus	145, 000	99, 200	17, 6
	Balmorhea	Lower Parks	5, 900	6, 400	5, 5
	Carlsbad	Alamogordo	131, 900	23, 200	32, 0
		Avalon	6, 600	1, 800	3, 6
		McMillen	38, 700	(2)	2
	Colorado River	Marshall Ford	810, 500	21, 500	800, 6
	Rio Grande	Caballo	345, 900	78, 600	137, 0
		Elephant Butte	2, 197, 600	19, 100	277, 7
	Tucumcari	Conchas	269, 100	108, 700	74, 6
Region 6	Missouri River Basin	Angostura	92, 000	41, 000	50, 6
		Boysen	560, 000	152, 400	495, 0
		Heart Butte	68, 700	60, 700	62, 4
	Belle Fourche	Belle Fourche	185, 200	117, 800	65, 6
	Fort Peck	Fort Peck	11, 400, 000	7, 821, 500	8, 173, 3
	Milk River	Fresno	127, 200	145, 000	85, 9
		Nelson	68, 800	37, 000	29, 7
		Sherburne Lakes	06, 100	(2)	18, 9
	Rapid Valley	Deerfield	15, 100	15, 100	13, 9
	Riverton	Bull Lake	155, 000	61, 200	56, 0
		Pilot Butte	31, 600	13, 600	23, 5
	Shoshone	Buffalo Bill	394, 600	202, 300	154, 8
	Sun River	Gibson	105, 000	60, 900	58, 4
		Pishkun	30, 100	23, 000	17, 5
		Willow Creek	32, 400	25, 400	21, 4
Region 7	Colorado-Big Thompson	Granby	467, 600	201, 900	350, 4
		Green Mountain	146, 900	77, 000	78, 5
		Horsetooth	151, 700	68, 700	116, 2
		Shadow Mountain	1, 800	1, 400	1,
	Missouri River Basin	Bonny	(2)	33, 400	28,
		Cedar Bluff	131, 700	97, 400	69, 7
		Enders	36, 000	30, 400	25, 7
		Harry Strunk Lake	35, 000	33, 400	32,
	Kendrick	Alcova	190, 300	158, 800	155,
		Seminoe	993, 200	502, 800	546,
	Mirage Flats	Box Butte	30, 600	31, 200	22,
	North Platte	Guernsey	44, 200	34, 900	30,
		Lake Alice	11, 400	(2)	2,
		Lake Minatare	60, 800	28, 200	22,
		Pathfinder	1, 040, 500	937, 000	867,

[1] Available for irrigation.

[2] Not reported.

RESERVOIR STORAGE
SHOWN IN PERCENT OF CAPACITY



	ARIZ.	CALIF.	COLO.	IDAHO	MONT.	NEBR.	N. MEX.	NEV.	OKLA.	OREG.	S. DAK.	TEXAS	UTAH	WASH.	WYO.
NUMBER OF RESERVOIRS REPORTED	8	22	47	9	14	3	6	7	1	25	1	2	14	7	10
CAP. OF REPORTED RESERVOIRS IN THOUSANDS OF ACRE FEET	3527	2968	1879	3364	1018	2242	3658	1371	149	2925	198	2844	3347	1082	3841

Explanation: Most State averages for reported reservoirs are for full 10 year period, but in a few cases reservoirs having shorter records are included. Does not include Millerton or Shasta reservoirs (combined capacity 5,020,500 acre-feet); April 1 combined storage 4,061,100 acre-feet. Does not include John Martin reservoir (capacity 655,000 acre-feet); April 1 storage 20,000 acre-feet. Does not include Fort Peck reservoir (capacity 19,000,000 acre-feet); April 1 storage 12,750,000 acre-feet. Does not include Flathead Lake (capacity 1,791,000 acre-feet); April 1 storage 641,000 acre-feet. Does not include Hungry Horse reservoir (capacity 3,500,000 acre-feet); April 1 storage 719,700 acre-feet. Does not include Lake Mead (capacity 27,217,000 acre-feet); April 1 storage 17,764,000. New reservoir in 1945. Does not include Roosevelt Lake (capacity 5,220,000 acre-feet); April 1 storage 2,183,000 acre-feet. Does not include Boysen reservoir (capacity 820,000 acre-feet); April 1 storage 557,000 acre-feet. (These are total capacities—the table on page 102 shows active capacity available for irrigation.—Ed.)

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percent of the 10-year normal, 1941–50, and flow of the Gila seems likely to equal only 15 pereent normal for the same period. Inflow into the Salt-Verde system peaked about March 21—irrigation requirements then began to exceed streamflow.

Fortunately, fairly substantial water reserves have been accumulated on the Salt-Verde system—not quite as good as last year but at least better than the past 10-year average. Roosevelt reservoir now stores 1,049,000 acre-feet compared with 682,000 acre-feet last year and 652,000 acre-feet average for the 10-year period, 1941–50. However, important San Carlos reservoir on the Gila River now stores water only to 1 percent of capacity, with dismal prospects for further inflow. Last year San Carlos stored 160,000 acre-feet on April 1—12 percent of capacity. Storage on April 1, 1952 was only 14,500 acre-feet.

In recent years increasingly efficient water management is being practiced by farmers and irrigation companies in Arizona. It seems evident that the sharpest sort of water management will be called for in Arizona in 1953.

Flow of the Colorado River into Lake Mead for April–September will be about 60 percent of normal or near the minimum flow experienced since the reservoir was completed.

California—Water conditions in California are generally unsatisfactory except in the Klamath and Upper Sacramento Basins. Deficient precipitation during February and March resulted in far less than normal increments to the snow pack, the water impounded in reservoirs, and the water levels of the groundwater basins. The outlook for California based on the availability of surface water to meet irrigation demands during 1953, although generally unsatisfactory does not appear to be critical except in portions of Southern California and the southern San Joaquin Valley. Power output in the State will not be adversely affected by the deficiencies in surface water supply due to the high degree of integration among major hydro- and steam-electric plants.

The snow pack throughout the Cascade Mountains and the Sierra Nevada is considerably less than that of 1 year ago. Water content varies from 120 percent of normal in the upper Sacramento River watershed to about 60 percent of normal in the southern Sierra Nevada. Normal precipitation conditions for the remainder of the season will produce normal or above normal snow melt runoff in the north coastal area and the Sacramento River watershed above Shasta Dam. Snow melt runoff for San Joaquin Valley streams will vary from 45 to 75 percent of normal. Under the assumption of no additional precipitation during the remainder of the season, the indicated snow melt runoff during the April–July period would be near normal in the north coastal area and from 25 to 70 percent of normal in the Central Valley area.

Colorado—The flow of all streams originating in mountain areas in Colorado will be below normal for the 1953 season. Critical shortages of water are expected on the Arkansas, Rio Grande, and the southern tributaries of the South Platte. Actual flow will range from about 80 percent of normal on the upper Colorado River to 40 percent of normal on the Rio Grande and San Juan.

In irrigated areas on the South Platte and tributaries a shortage of water is expected except on the Cache la Poudre, Big Thompson, and lower South Platte. On these streams supplemental water will be available from the Colorado-Big Thompson project. Even normal water supply is usually inadequate for the highly developed South Platte irrigated area. Storage in smaller irrigation reservoirs is about the same as a year ago but below the average of past years. On the Arkansas River the outlook is very poor. Stream-flow there will be below normal; there is practically no reservoir storage and

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APPLYING WATER TOO FAST may endanger crops and soil.

INVESTIGATE before you INVEST

by CLAUDE H. PAIR, Irrigation Engineer Division of Irrigation Engineering and Water Conservation, Soil Conservation Service, Boise, Idaho

and L. R. SWARNER, Irrigation Engineer Bureau of Reclamation, Boise, Idaho

"FOR SALE—80 acre agricultural sprinkler system by owner."

So read an advertisement in a local newspaper last spring.

Fortunately, there have not been many "ads" like this. Fortunately, we say, not because we are opposed to the resale of irrigation equipment but because the chances are great that in the long run this system may prove to be the most expensive even though the purchase price is considerably below that of new equipment.

"How could such a system cost me more money than new equipment?" you ask. "Haven't I read where a sprinkler system saves water, saves labor and increases yields?" Yes, you probably have, but not every system will save you money, water, labor, or will produce more crops. How could this happen?

Buying a used sprinkler system is like going u to the suit rack of a local department store, pick ing up a suit, paying for it, and taking it hom without trying it on for size, length of trouser and size of vest. If you were lucky it might fi but the chances are great that it won't. A prop erly designed sprinkler system may be compare with a tailor-made suit. It exactly fits the farm for which it was designed. Using it elsewher usually results in a misfit in one place or anothe

Although we have pointed out the danger o buying a used sprinkler system which does not f a farm, equal danger exists in buying a new sy tem unless careful consideration is given to th factors which influence the design and operatio of the sprinkler system. Generally speakin sprinkler equipment dealers can be relied upon design systems properly. However, it is possib for a farmer to purchase various parts of sprinkl equipment and assemble his own system.

A sprinkler system must be designed to fit t farm on which it is to be used, taking into co sideration the maximum water requirements of t crops grown throughout the normal rotation. I general, revolving head sprinkler systems mu meet the following performance requirements:

1. *Application Rate*—Water should not be applied at a rate faster than the soil will take it in. However, it should be applied fast enough to prevent excessive evaporation loss.

2. *Depth of Application*—At the point of lightest application, the amount of water applied for an irrigation should not be greater than can be held by the soil within the root zone of the crop. Greater amounts should be applied only when leaching is necessary to remove harmful salts.

3. *System Capacity*—There should be enough equipment, and of sufficient size, to replenish soil moisture at a rate at least equal to the peak rate of use by the crop, taking into consideration the highest water use crop in normal rotation.

4. *Uniformity of Application*—Water should be applied as uniformly over the field as is practicable. The point of lightest sprinkling should usually have a depth of application of at least 80 percent of the average depth applied over the field. The uniformity of application is affected by variations between discharges of the individual sprinklers along a lateral and on different laterals. It is also affected by the uniformity of spray distribution within the effective area of individual sprinklers.

5. *Economical Pipe Sizes*—The initial cost of small-sized main and lateral pipelines is less than larger pipelines. However, small-size pipelines require more power than larger pipelines because of increased water friction. This increases the cost of sprinkler system operation. The distribution pipe size should be such that there is an economic balance between pipe cost and power cost.

6. *Crop Damage*—Water must be applied in such a manner that it will not physically damage the crop. If you are in the market for a sprinkler system, shop around among various dealers, but don't buy the cheapest system they offer because usually the cheaper system does not have enough lateral or sprinkler heads included to permit you to irrigate the farm properly during the high water demand period of your crop. Here, as in most cases, you get just what you pay for.

The lack of adequate moisture during the peak growing season results in a lowered production in some crops and, in other crops, lower grade produce. There is less income any way you look at it. The cheapest sprinkler system may prove very expensive in the overall seasonal operation if it is underdesigned for the farm.

Proper design alone is only one-half the key to success with a sprinkler irrigation system. It should be run in keeping with good irrigation practices. Too often farmers have the mistaken impression that a sprinkler system is a "cure-all" for all irrigation problems.

How should a sprinkler system be operated?, you ask. There are several general rules that should be followed.

1. Irrigate only when the crop needs to be irrigated. Keep in mind that there is a time lag for complete coverage of the farm with a sprinkler system. Once you get behind crop needs it is rather difficult to catch up because of the limit of the capacity of the system. Testing the soil moisture will determine when to irrigate. If soil moisture is adequate over the entire farm, shut off the sprinklers for a few days during this slack period. You'll save water and labor.

2. Apply only enough water to fill the soil with moisture throughout the root zone. Often when establishing new crops only a few inches of surface soil need to be moistened. The sprinkler system should be operated long enough to supply this moisture. One of the most common abuses is to operate it full-time throughout the entire irrigation season when it has been designed for full-time operation only during the period of peak moisture demand, which usually occurs during the midsummer months. This over-irrigation and the resulting loss of water occurs in the spring and fall. In addition to the cost of the extra water as well as the cost of applying it, overirrigation may carry valuable soluble nitrates below the reach of the plant roots. This would require the farmer to apply more fertilizer to obtain good crop production. Overirrigation may also cause drainage problems. If your sprinkler system is designed to cover the farm in 10 days during the peak water-use period, running continuously, then in the spring and fall it will need to run only one-third to one-half that time.

For successful results with a sprinkler system, an adequate and proper design cannot be overemphasized. Information on proper design may be obtained from the dealer, Agricultural Extension Service, and Soil Conservation Service, the Bureau of Reclamation, and private irrigation engineers. With a properly designed sprinkler system, properly operated, you should produce as much or more crops than your neighbor regardless of his method of irrigation. ###

Water Report

Continued from page 103

precipitation has been deficient at valley elevations for several months. The soil is dry.

The water supply outlook for the Rio Grande and tributaries in Colorado is poor but better than for the very dry years of 1950 and 1951. Reservoir storage carried over from the high flows last year is above normal. Valley soil moisture is fair and groundwater for subirrigation is at high levels. Streamflow will range from 40 to 60 percent of normal.

West of the Continental Divide there will be some shortage of water on smaller streams and on the Dolores and San Juan tributaries. Colorado-Big Thompson Reservoirs may be used to partially regulate flow on the upper Colorado. Soil moisture conditions in irrigated areas in western Colorado are fair to good.

IDAHO—The snow pack over most of Idaho is normal or nearly so. The snow line, in general, is high and low altitude snow courses are generally slightly proportionately lower in snow cover than the courses higher in the mountains. Recent rain over the lower part of the river basins has partially erased the dry soil conditions found last fall before the snow began to accumulate. April–September streamflow is expected generally to be 95 percent normal. Reservoir storage for the State is 14 percent above average for this time of the year. Reservoir operators started to store water early in the winter, foreseeing this as the first year for more than five years when the water supply would be unlikely to exceed normal.

MONTANA—Snow cover on the upper Columbia Basin is good. At present, the Flathead Basin has about an average snow cover, while the Clarks Fork Basin is slightly above average. A good water supply for irrigation and other uses should result throughout the basin.

Snow cover east of the Continental Divide on the upper Missouri River Basin averages about 85 percent normal. The soil is not frozen under the snow, and the soil is generally dry to damp. Only in a few places was wet soil encountered on the watersheds.

Snow density is generally high for April 1st. The snow is loose and granular. These two factors indicate that an early runoff is possible with the dry soil absorbing considerable water for soil priming.

Farming operations in areas below reservoirs should have a good water supply for most of the season, while those areas using water from unregulated streams are likely to find themselves short of water for irrigation purposes during late July and August.

NEVADA—Snow stored water ranges from good in the central Sierra to fair in northeastern Nevada and poor in the central and southern part of the State.

United States Geological Survey reports October through March streamflow along the Humboldt and eastern Sierra above normal. Groundwater levels are reported as slightly below normal.

Reservoir storage on April 1 averaged 83 percent of capacity and 120 percent of the past 10-year average.

1953 snow-water runoff will be normal or below for all streams in the State. The southern half of Nevada can expect very little if any snow-water runoff. Along the Humboldt tributaries, streams can expect 50 to 75 percent of normal while the main stem will flow only about 30 percent normal. Runoff into Nevada from the east central Sierra will range from 70 percent normal in the south to normal in the north.

NEW MEXICO—The water supply outlook for the Rio Grande and its tributaries in New Mexico is for gravely deficient flow in 1953. The overall statewide water supply is likely to be the least in the past 25 years.

Soils in irrigated areas along the Rio Grande are very dry. El Vado Reservoir is empty in compliance with the Rio Grande compact and probably will not be able to store water this year. The irrigation supply for the middle Rio Grande irrigated area will be extremely limited.

Elephant Butte and Caballo Reservoirs now contain 420,000 acre-feet. This is four times that stored a year ago at this date. However, the total of storage plus expected inflow into the reservoirs will not exceed 60 to 70 percent of the normal irrigation water demand.

OKLAHOMA—The water supply outlook on the W. C. Austin project in Oklahoma is very poor at this time. The reservoir stores 17,600 acre-feet or 20 percent of capacity. There has been no inflow to the reservoir since June 1952. (NOTE.—This information is from Reg. 5, U. S. Bureau of Reclamation, Amarillo, Tex.)

OREGON—Oregon's 1953 water supply outlook dependent on mountain snow cover, is "fair" to "good" with serious deficiencies to be expected only in the smaller streams heading in low elevation watersheds. Water content of mountain snow cover averages 109 percent of normal statewide on 124 measured snow courses, although only 70 percent of last year at this date. Reservoired water in 25 reporting reservoirs is 120 percent of average and will "save the day" for water users in many areas otherwise facing irrigation deficiencies. Effects of last year's long summer and fall drought have been largely eased by heavy winter precipitation and resultant mountain snow cover. Cropland soils have an excellent moisture content.

SOUTH DAKOTA—Reservoir storage in the Black Hills area of South Dakota is down substantially from last year and about one-half of average. Snow cover is slightly above normal. Soil moisture conditions in irrigated areas are reported as fair to good.

UTAH—With the exception of a peculiarly narrow belt of normal runoff prospects running across the State from the Salina Creek-Fish Lake area to the La Sal mountain area near Moab, another small area in the Farmington-Bountiful vicinity and a strip draining into Wyoming from the high Uintahs, all other parts of the State can except below average runoff during this irrigation season.

In the southwest Utah runoff of the main and east forks of Sevier River above Piute Reservoir, the Escalante, Virgin, and Beaver Rivers and Coal Creek near Cedar City will be of severe drought proportions comparable to that of 1951, with runoff expectancy varying from 20 to 45 percent of the 1941–50 average. Runoff prospects for the Beaver River is the poorest since 1934.

Prospective runoff for Strawberry and Whiterocks Rivers and Ashley Creek in the Uintah Basin, ranges from 50 to 60 percent average.

Runoff for all other streams of the State will range from 60 to 80 percent of the 10-year average. Very fortunately, holdover storage in 14 principal reservoirs now rests at 79 percent of capacity equaling 156 percent of the 10-year average. This means that water users in central and northern Utah, having storage rights, will have sufficient water during the irrigation season, whereas, water users depending solely upon natural flow rights can expect definite shortage of water.

WASHINGTON—Snow surveys on the headwaters of the Columbia River in Canada and other major contributing rivers in the United States indicate a lower than normal water supply for this season. The flow of the main stem of the Columbia is forecast for the lowest flow in 8 years if a normal spring melt season ensues. Water stored in smaller reservoirs (F D R excluded) is normal for this time of the year. New reservoirs, notably Hungry Horse, on the upper reaches of the main rivers will fortunately increase the water supply that can be used for power or irrigation during the normal low flow period.

WYOMING—Summer streamflow in most but not all of Wyoming is expected to be well below normal for the 1953 season. On the Green River the 1953 flow is forecast at 52 percent of normal, the least since 1940. Since

·rigation along the Green River is limited to mountain ıeadows local water supply should be adequate.

Although inflow to Seminoe Reservoir on the North 'latte will be much less than normal in 1953, adequate ·rigation water supplies in eastern Wyoming and western Nebraska are assured for this season. As a result of bove normal flow the past few years there is now stored ı the four major reservoirs along the North Platte in Vyoming 1,600,000 acre-feet. This is practically the same s a year ago but well above the average. The reservoirs ere nearly at capacity at the end of the 1952 snow melt eason but were reduced substantially because of high ·rigation water demands in the summer months of 1952.

On the Laramie River and other smaller North Platte ·ibutaries irrigation water shortages may be expected ecause carryover storage is not available.

The 1953 snow pack over the Wind-Big Horn River asins averages 75 to 80 percent of average.

Those areas operating under reservoir-regulated treams should have a fair water supply for this coming eason, but farm areas depending for water upon unresrvoired streams can expect late season shortages.

Water users in Western Wyoming along the Snake nd its tributaries are assured of an average water supply lthough reservoir storage is 6 percent below normal.

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Rotation Grazing

by LITER SPENCE, Range Specialist, University of Idaho Extension Service

Rotation grazing pays for its fences, and then ome. The rotation idea requires that the pasture ıe divided into 3 or 4 fields. Stock are permitted ın one section at a time. The other areas put on resh growth. The use of a number of pastures, ather than one, as in old-style conventional grazng, calls for more fencing and watering places. However, the increased returns, particularly vhere alfalfa or ladino clover make up an important part of the pasture mixture, will more han justify increased cost of fencing. Electric ences can be used to advantage.

Top growth of forage determines the root growth, for without the top there can be no plant ood production to feed the root systems and increase top growth. A simple guide to good mangement is the stubble height or the closeness of grazing that is allowed. It is just as easy to mainain a six to eight inch stubble on a healthy pasture s it is to maintain one inch of stubble on a poor pasture. More forage will be produced by mainaining high stubble than where a pasture is grazed o the ground. This also provides an insurance factor, for if for some reason the pasture becomes short, this high stubble can be used in an emergency. Such a practice will set the growth back emporarily, but it is not permanent. Repeated close cropping will result in permanent injury.

#

"WATER IN THE WEST" HONORED

Assistant Secretary of the Interior Fred G. Aandahl (right) congratulates Ben Glaha, Chief Photographer, Reclamation Region 2, Sacramento, upon the Department's receipt of a certificate from the Edinburgh Film Festival for Reclamation's film, "Water in the West." Glaha, holder of many honors, including the Interior Department's Distinguished Service Award, for his outstanding photography of Reclamation works over two decades, made the motion picture.

The certificate was presented to Mr. Aandahl, who received it on behalf of the Department, by Sir Roger Makins, British Ambassador, at a ceremony in the Interior Auditorium on March 27.

The Edinburgh Film Festival is held annually to inspire world progress in the film arts. Each country is invited to send its best motion pictures. "Water in the West" was chosen one of the outstanding documentary films of the year for showing at the festival to an international audience. •

Editor Sadler Resigns

Ruth F. Sadler, who has been editing the Reclamation Era since 1946, has resigned effective at the close of business March 12. She is accompanying her husband, George E. Sadler, to Rio de Janeiro, Brazil, where he has accepted an assignment with the Institute of Inter-American Affairs.

J. J. McCarthy will be your Acting Editor for the time being. •

NOTES FOR CONTRACTORS

Contracts Awarded During March 1953

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Co am
DC-3825	Boise, Idaho	March 12	Alterations to Arrowrock Dam	Quinn-Robbins Co., Inc., Boise, Idaho.	$1
DS-3855	Gila, Ariz	March 17	Five 4,160-volt synchronous motors for Wellton-Mohawk pumping plants Nos. 1, 2, and 3.	Electric Products Co., Cleveland, Ohio.	1
DC-3860	Vermejo, N. Mex	March 4	Construction of dams and dike for reservoir rehabilitation.	Colorado Constructors, Inc., Denver, Colo.	8
DC-3863	Grants Pass, Oreg	March 9	Rehabilitation of Savage Rapids Dam	Young and Smith Construction Co., Salt Lake City, Utah.	3
DC-3869	Missouri River Basin, Nebr	March 12	Remodeling and initial construction for Kansas River District headquarters office building at McCook, Nebr., schedules 1 and 3.	Korshoj Construction Co., Inc., Blair, Nebr.	1
DC-3869	do	March 13	Remodeling and initial construction for Kansas River District headquarters warehouse at McCook, Nebr., schedule 2.	Robert E. Phillips Co., McCook, Nebr.	
DC-3871	Boulder Canyon, Ariz.-Nev.-Calif.	March 9	Construction of earthwork, pipelines, and structures for laterals 116.1 and 118 and sublaterals, part 1 of unit 8, Coachella Valley distribution system, All-American Canal system.	R. V. Lloyd and Co., Coachella, Calif.	4
DC-3872	do	March 11	Construction of earthwork and structures for equalizing reservoir near Coachella canal, All-American canal system.	Robert E. L. Parker Co., Claremont, Calif.	
DS-3874	Missouri River Basin, Mont	March 10	62,000 barrels of bulk portland cement for Tiber Dam.	Ideal Cement Co., Denver, Colo.	2
DC-3877	Columbia Basin, Wash	March 27	Construction of earthwork and structures for East Low canal and Scooteney wasteway.	J. A. Terteling and Sons, Inc., Boise, Idaho.	2,[illegible]
DC-3878	Davis Dam, Ariz.-Nev	March 19	Additions to Cochise and Phoenix substations	Howard P. Foley Co., Salt Lake City, Utah.	
DC-3880	Central Valley, Calif	March 13	Construction of earthwork, concrete pipelines, and structures for laterials 6.2, 7.1, and 7.3, Contra Costa County Water District, Contra Costa canal distribution system, schedule 1.	Coast Pipeline Contractors, Belmont, Calif.	3
DC-3880	do	do	Construction of earthwork, concrete pipelines, and structures for lateral 9.1, Contra Costa County Water District, Contra Costa canal distribution system, schedule 2.	Kevry Construction, Inc., San Leandro, Calif.	
DC-3883	Missouri River Basin, S. Dak	March 31	Additions and modifications to Huron, Mount Vernon, Sioux Falls, and Watertown substations for 115-kv operation.	Electrical Builders Assoc., Mayville, N. Dak.	1
DC-3892	Missouri River, S. Dak	March 27	Stringing conductors and overhead ground wires for 122 miles of Fort Randall-Sioux City 230-kv transmission line.	Campsey-Lytle-Richards, Denver, Colo.	[illegible]
117C-182	Columbia Basin, Wash	March 25	Babcock pump wastewater disposal system	Otis Williams and Co., Kennewick, Wash.	
117C-183	do	March 9	Chute and stilling pool repair, Rocky Coulee wasteway, Station 1+18 to Station 14+97.	L. D. Shilling Co., Inc., Moses Lake, Wash.	
617C-32	Riverton, Wyo	March 2	Buried asphaltic membrane lining for Wyoming Canal, Station 1709 to Station 1738 and Station 1865 to Station 1870.	Studer Construction Co., Billings, Mont.	
617C-33	do	March 19	Channel relocation and erosion control works along Five Mile Creek.	Lichty Construction Co., Riverton, Wyo.	[illegible]
601C-30	Shoshone, Wyo	March 24	Buried asphaltic membrane lining for laterials R-4-S, Station 76+45 to Station 148+24.7.	Taggart Construction Co., Cody, Wyo.	
601C-31	do	March 26	Closed drains	Hicks Construction Co., Riverton, Wyo.	

Construction and Materials for Which Bids Will Be Requested by July 1953

Project	Description of work or material
Boise, Idaho	Relocation and construction of community facilities at Arrowrock dam near Boise, Idaho.
Cachuma, Calif	Construction of Goleta distribution system laterals Nos. 10 to 16, and pumping plant in lateral area 13-1, along U. S. Highway 101, between Goleta and Santa Barbara, Calif., requires furnishing and laying about 12 miles of 2- to 14-inch diameter steel pipe and constructing a plant to house one 100-gpm and three 200-gpm pumps at 225-foot head, and install 1 pump of each size. The plant will have a steel air chamber with compressor for equalizing line pressures.
Central Valley, Calif.	Furnishing and erecting prefabricated metal buildings at Tracy pumping plant, near Tracy, Calif., as follows: one each 40- by 40-foot, 20- by 100-foot, and 40- by 100-foot; and 20- by 140-foot and 40- by 100-foot car stalls, with concrete foundations and concrete floor slabs or asphalt pavement floors. Electrical wiring, water and sewer lines, and electrical heat and evaporative coolers in garage also included.
Do	Installing new oil lines for Tracy switchyard.
Do	Constructing roads and providing drainage for Tracy switchyard.
Central Valley, Calif.—Continued	Construction of 11 miles of 12- to 30-inch concrete lines, including 12 gravity turnouts and 12 tu with pumping plants of 9 to 2 cfs capacities Plainview Water Irrigation District distributi tem on the Delta-Mendota canal, about 5 miles west of Tracy, Calif.
Do	Installation of a Government furnished 100-cfs unit and several flap gates in each of pumping Nos. 1, 2, 3, and 4 on the Contra Costa canal b Antioch and Martinez, Calif.
Do	Construction of 58 miles of 12- to 66-inch diamete forced concrete pipe line, monolithic concrete screens, and low-head pumping plants, valve gates, miscellaneous metalwork, and electrical for Unit 1 of Delano-Earlimart Irrigation distribution system, Friant-Kern canal, lo Tulare county near Earlimart, Calif.
Columbia Basin, Wash.	Construction of office building, general purpose storehouse, and a 10-car garage for Royal Water headquarters. Office is to be of brick veneer an buildings of concrete block.
Do	Drilling water supply wells for ditchriders' sites in areas W-6A and W-8 near Quincy, Wash., a wells in area E-4 near Warden, Wash.

Construction and Materials for Which Bids Will Be Requested by July 1953—Continued

Project	Description of work or material
umbia Basin, ash.—Continued	Moving 6 two-bedroom temporary houses from present government camps to new locations near Quincy and Warden, Wash., and remodeling into two-bedroom houses with basements. Also included is construction of garages, pump houses, streets, and installation of utilities.
Do	Grading and paving 1,000 feet of access roadway in industrial area, and clean up of former compressor house area at Grand Coulee Dam.
Do	Construction of area W-6B laterals, sublaterals, and wasteways, varying from 90 to 2 cfs capacities on West canal near Quincy, Wash.
, Ariz	Construction of 2.4 miles of 220-cfs Dome canal and 2.6 miles of 100-cfs lateral D-1.4E, near Dome, Ariz. Structures on Dome canal include river siphon, road siphon, radial gate check, three bridges, and turnouts.
Do	Construction of 28 miles of concrete-lined canal and laterals of 220 to 15 cfs capacities, 7 pumping plants of 80 to 15 cfs capacities, Unit 1 of Dome canal and distribution system, about 10 miles east of Yuma, Ariz.
Do	Vertical-shaft, motor-driven, propeller-type pumping units having the following capacities: three units each of 26.7 cfs at 21.5-foot head; four units of 15 cfs at 10-foot head; one unit of 15 cfs at 15-foot head; three units of 15 cfs at 7-foot head; and one unit of 15 cfs at 4-foot head, all for Dome distribution system.
idoka, Idaho	Drilling and casing 20 irrigation wells for North Side pumping division, near Rupert, Idaho.
Do	Construction of laterals from 20 irrigation wells for North Side pumping division.
ssouri River isin, Iowa.	Construction of 66,667-kva Sioux City substation near Sioux City, Iowa, will involve furnishing and erecting steel structures and a 42- by 62-foot masonry control building and installing government furnished electrical equipment.
Do	Main control board, distribution boards, and battery chargers for Sioux City substation.
ssouri River isin, Mont.	Construction of Missouri diversion dam, 4 miles southwest of Frazer, Mont., is to comprise 2.3 miles of earth dike embankment across the Missouri River, a 40-foot high gated concrete overflow section for seven 80- by 6-foot crest gates, and 350 feet of concrete retaining walls 35 to 60 feet high. The earth dike is to be 25 feet high for 11,000 feet and 45 feet high for 1,000 feet.
	The 3-unit, 18,000-kw Little Porcupine power plant will have a reinforced concrete substructure 103 by 188 feet and 70 feet high; and a government-furnished steel superstructure 57 by 188 feet and 45 feet high, with insulated steel panel walls. The upstream portion of the power plant structure is designed to act as a gravity
Missouri River Basin, Mont.—Con.	dam against the reservoir. The contractor will construct concrete spiral casings and install embedded parts of three turbines, each 8,400 horsepower at 30-foot head, and install traveling cranes. Also included are headworks structures for Missouri and South Side canals.
Missouri River Basin, Nebr.-Kansas.	Construction of 11 miles of unlined Naponee canal, laterals, drains, and appurtenant reinforced concrete structures will require 200,000 cubic yards of excavation and about 8,000 feet of 18- to 28-inch diameter concrete pipe, capacity ranging from 36 to 6 cfs. Work is on south side of Republican River beginning at Harlan County Dam, 12 miles west of Franklin, Nebr.
Do	Construction of 18 miles of unlined laterals varying from 12 to 6 cfs capacities with appurtenant reinforced concrete structures for Franklin canal's first section, near Franklin, Nebr.
Missouri River Basin, N. Dak.	120,000 pounds of fabricated galvanized structural steel for bolted structure additions to Bismarck substation.
Provo, Utah	Placing earth lining on a 0.5-mile reach of existing 1,000-cfs Weber-Provo diversion canal, 3 miles north of Kamas, Utah.
Rio Grande, N. Mex.	Furnishing material and stringing 2 galvanized steel overhead ground wires on 360 miles of existing 115-kv transmission lines.
Vermejo, N. Mex	Rehabilitation of Vermejo diversion dam, 11 miles of 600-cfs Vermejo canal, and 24 miles of 300-cfs Eagle Tail canal, 8 miles northwest of Maxwell, N. Mex., including revising the diversion dam headworks structure, enlarging the outlet structure to 450 cfs capacity, and installing nine slide gates.
Yakima, Wash	The combined Chandler power and pumping plant to be constructed on the Yakima River about 9 miles downstream from Prosser, Wash., will consist of a 12,000-kw power plant to house two 6,315-kva generators, and a 500-cfs capacity turbine-driven pumping plant to house an initial two and an ultimate three 167-cfs units. The headworks consist of a gated iceway 20 by 3 feet, four siphon spillways discharging into a 1,500-cfs, 390-foot long spillway chute; a 4-foot diameter sluice gate, a trashrack structure at entrance to two 120-inch power penstocks, and three 87-inch pump supply lines. The contractor will construct a 3,500-foot long, 99-inch diameter, 250-foot-head pump discharge line across the Yakima River to the Main canal and furnish either steel pipe or concrete pipe, steel-lined for 2,300 feet. He will install embedded parts of two 8,500-hp and two 2,600-hp government-furnished turbines and a 30-ton bridge crane; and construct a railroad bridge and highway bridge.

United States Department of the Interior, Douglas McKay, Secretary
BUREAU OF RECLAMATION OFFICES AS OF APRIL 15, 1953

Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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REGION 2: R. L. Boke, Regional Director, Box 2511, Fulton and Marconi Avennes, Sacramento 11, Calif.
REGION 3: E. G. Nielsen, Regional Director, Administration Building, Boulder City, Nev.
REGION 4: E. O. Larson, Regional Director, 32 Exchange Place, P. O. Box 360, Salt Lake City 10, Utah.
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REGION 7: Avery A. Batson, Regional Director, Building 46, Denver Federal Center, Denver, Colo.

Water--is Wealth

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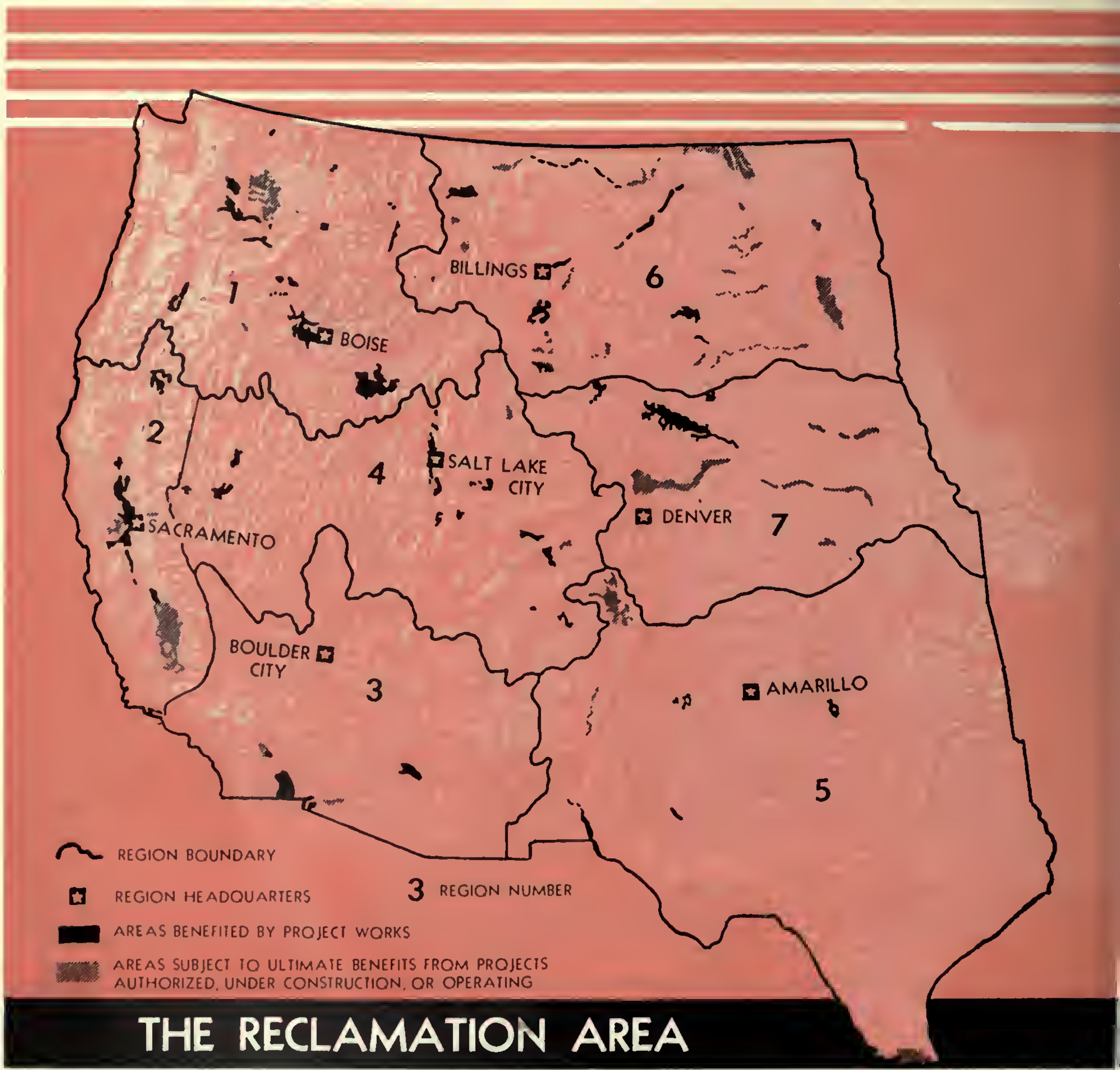

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The Reclamation Era

Official Publication of the Bureau of Reclamation

June

1953

IN THIS ISSUE

June 1953

Volume 39, No. 6

The Reclamation ERA

25 Years Ago In The Era

The preservation of the farming business on a basis which will maintain on the land a rural population that may continue to contribute to the public welfare something more than an adequate food supply is essential to the permanent well-being of this country. (From the inside front cover of the June 1928 issue of the New Reclamation Era, predecessor to the RECLAMATION ERA.)

OUR FRONT COVER—SPRING PLANTING ON THE MINIDOKA PROJECT.—Homesteader Eugene C. Wilbur loads a drill with peas which are being grown for eventual use by a frozen food company. Mr. R. B. Wilbur, his father, waits for the task to be completed so that he may resume planting. *Photo by Stan Rasmussen, Region 1.*

DEPARTMENT OF THE INTERIOR March 3, 1849

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DESIGN AND ILLUSTRATIONS by Graphics Section, Bureau of Reclamation, Washington, D. C.

J. J. McCarthy, Acting Editor

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Water is Wealth

In this issue . . .

RECLAMATION PLACE NAMES IN THIS ISSUE

PROVO RIVER FISHING RENEWED.—1. Cascades in river formed by large boulders furnish ideal resting places, feeding pockets, and shade for large trout. 2. Rock barrier in main channel of river forms succession of terraced pools ideal for dry fly fishing during low water. 3. Rock barrier across river provides pool for trout. 4. Fishing for brown and rainbow trout on Deer Creek Reservoir. *Photos 1 and 4 by the author; 2 and 3 by F. H. Anderson, Region 4.*

PROVO RIVER REHABILITATED

by HACK MILLER
Fishing Editor, Deseret News

EDITOR'S NOTE: We are indebted to Mr. Hack Miller, Fishing Editor of the Deseret News, for the following article which appeared as his column "Rod and Gun" in the March 21 edition of the News. A brief description of the Provo River project and its purpose has been inserted in Mr. Miller's original article for the information of our readers.

Several years ago when the Bureau of Reclamation moved in on the Provo River in Utah and dredged it into a gutter-like cobblerock canal we moved in with a barrel of criticism. We figured, like all the other fishermen, that one of the State's finest waters had been ruined.

We were right, it had.

Why did the Bureau of Reclamation take this step? Because, it was necessary to build the Provo River project which would provide supplemental irrigation water for 46,000 acres of inadequately watered land in the Utah and Salt Lake Valleys, as well as furnish industrial and municipal water supplies to meet Salt Lake City's needs via the Salt Lake aqueduct. If the project had not been built, unless additional water supplies were developed to meet growing urban requirements, municipalities would be forced to take water from irrigated farms (exercising their preferential right to condemn irrigation water for municipal use).

Just to see what the river was like and what its future was going to be we joined with several experts from the bureau and went over the com-

plete dredged area last March. And it took most of a day.

Herewith we present the report of that trip and our own observations on what we think will eventually be the fishing fate of this fine stream.

We went afield with L. R. Dunkley of Provo, chief engineer on the project. With him were Claude Sherry, Mack Corbett, and Harold Anderson—all from the Bureau of Reclamation offices in Salt Lake and Provo.

The Bureau has just completed a riprapping project which has called for the hauling of 47,000 tons of large rocks to guard the shoreline of the river bed. Last season the river broke through in several spots. This year it won't be able to.

And in the process the Bureau, where it has been able to do it, has put some 5-ton boulders in the stream bed to make a home for the fish.

Shoreline Changes Made

The new shoreline made by the Bureau will have a tremendous effect in stabilizing the fishing. For several years now the fish have been without cover. An 8-inch cobblerock was about the biggest obstacle in the course.

It isn't so now. Fish can shade under the side

BANK FISHING near Charleston Bridge across the Provo River [cut off] the upper reaches of Deer Creek Reservoir. Lucky anglers occ[cut off]sionally land large trout. *Photo by the author.*

rocks, find habitat in the deep holes and even liv[cut off] in the many cascades.

The work done by the Bureau isn't a fisherman'[cut off] dream by any means. But it's a long step towar[cut off] a solution. Along the right-of-way the natura[cut off] trees and grasses are gone. Big stumps are bein[cut off] derricked from the river course so they won'[cut off] take out the bridges during flood water. A[cut off] these would help make fishing cover.

Fish Need Shade and Cover

We've found in our many years of fishing tha[cut off] fish require shade. Sometimes they get it in th[cut off] currents, under the mosses, along the willo[cut off] banks, or siding against a large boulder. The[cut off] can't stand the sun any better than us humans. I[cut off] they don't have shade they won't stay aroun[cut off] You can bet on that.

Mr. Dunkley tells us that the Bureau is ju[cut off] about through in limited areas. But the big wo[cut off] is finished. The stream will soon be left alone.

Where the stream has had a chance it has begu[cut off] to grow its mosses and water weeds. The growt[cut off] has been good. Give it a couple of years and [cut off] will come back nicely: It will never be the old Provo River. That is as certain as apples. But with a little time, nature will do her best.

Bureau Men Are Fishermen

E. O. Larson, regional director for the Bureau, is an ardent fisherman. So's Dunkley, Corbett, and others. They had a contract to supply water. Yet they didn't want to spoil the fishing.

They got one job done at the expense of the other and in the process, consistent with their engineering requirements, they have thoughts of the fisherman wherever possible. The improvements shown on the river during the past year have left little doubt about this.

The Bureau is anxious to leave the river alone now. There are still a few bottlenecks. These are minor, however.

Throughout most of the dredged area the river is making winding channels and creating some pretty suitable fishing holes. This is an improvement to say the least.

The future of the river depends on how badly it is tinkered with. If the bulldozers and draglines are kept out of the riverbed we'll have a fair fishing stream. If they are not, we'll have nothing more than a millrace. ###

NRA Board Members Confer With Interior Officials

Members of the Board of Directors, National Reclamation Association confer with Secretary of the Interior, Douglas McKay, and his staff at the Interior Department, on April 7, 1953.

Seated (left to right) are: LaSelle E. Coles, Oregon Director; Arthur Svendby, South Dakota Director; Fred G. Aandahl, Assistant Secretary of the Interior, Water and Power; Ralph A. Tudor, Under Secretary of Interior; Douglas McKay, Secretary of the Interior; C. Petrus Peterson, President, N. R. A., and Nebraska Director; A. N. Smith, Nevada Director; Dr. E. Porter Ahrens, for Paul Applegate, Kansas Director; H. H. Moeur, Arizona Director; Charles L. Kaupke, California Director. Standing (left to right) are: Frank Raab, Oklahoma Director; Harry E. Polk, North Dakota Director; E. R. Wells, Washington State Director; Earl T. Bower, Wyoming Director; N. V. Sharp, Idaho Director; William E. Welsh, Secretary-Manager, Washington, D. C.; Herbert L. Buck, Treasurer and Montana Director; D. D. Harris, Utah Director; J. E. Sturrock, Texas Director; Harold H. Christy, Colorado Director; and Lyman B. Horton, Railroad Representative. •

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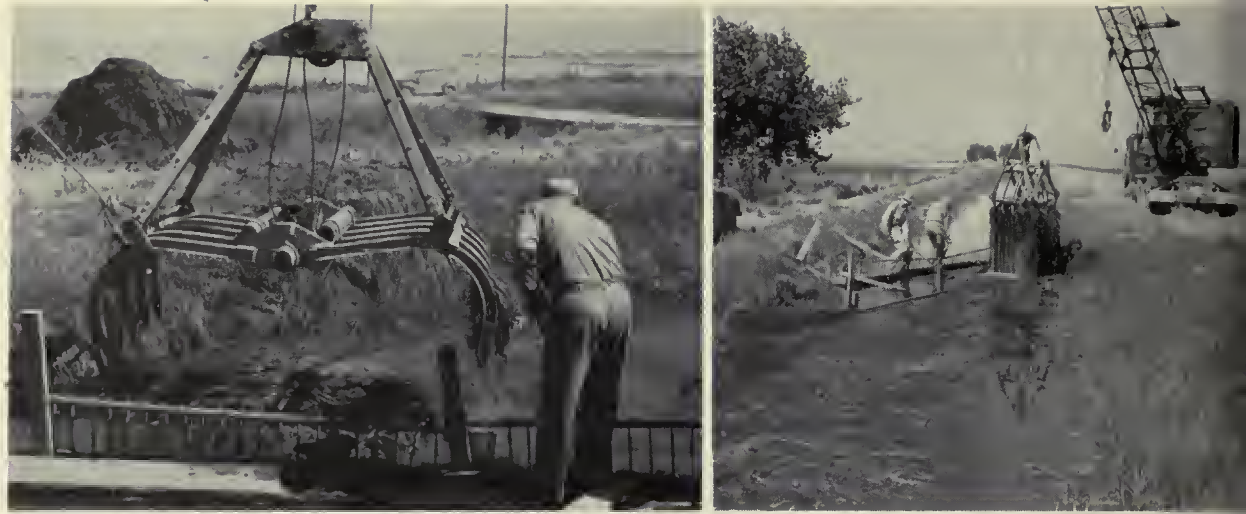


"MOSS FORK" in a close-up just before it is dropped into the woter. At right, truck dragline in operation lifting weeds from loter os they float into homemade guide. The trap in these photos is the one previously used. *Photos by A. M. Bergloff, Region*

KLAMATH'S "MOSS FORK AND TRAPS"

by E. C. CAKIN, Agriculturist
Klamath Project, Oregon-California

An extensive system of open drains which is essential to the reclamation of 190,000 acres of irrigated land of the Klamath project totals over 500 miles in length, and is weed infested more than usual because of the large amount of water carried and the flat gradients and slow current. Nearly all the drain discharges are evacuated by pumps of various sizes—over 30 in number.

The types of water plants most prevalent: Sago pond weed (Potamogeton Pectinatus), Richardson pond weed (Potamogeton Richardsonii), Coontail (Ceratophyllus demersum), and common waterweeds (Anacharis Canadensis).

Keeping the drains open is a major problem. Several methods of control are in general use—aromatic solvents, chaining, and dredging. The removal of the dislodged weeds that have floated downstream to the pumps or to culverts and siphons has in past years been done to quite an extent by hand labor at a relatively high cost. The savings therefore due to the use of the device and system here described has been very gratifying and it is believed is worth the consideration for other projects with like problems.

For many years the pulling of moss from ditches was done with the hand fork, requiring up to laborers each season. Except for the smaller la erals, where aromatic solvents are used, chainin for moss control is still prevalent. In an attemp to reduce the manpower used in this work, Luth McAnulty, irrigation manager of the Tule Lal Division of the Klamath project, purchased crane-operated Blaw-Knox sugarcane grapple fork. This fork was modified by adding tw prongs and a heavy weight to each jaw. Th weights were needed to give faster and more pos tive action in opening and closing. This fork wa worked by a truck crane, giving it the require mobility to move around to various ditches required.

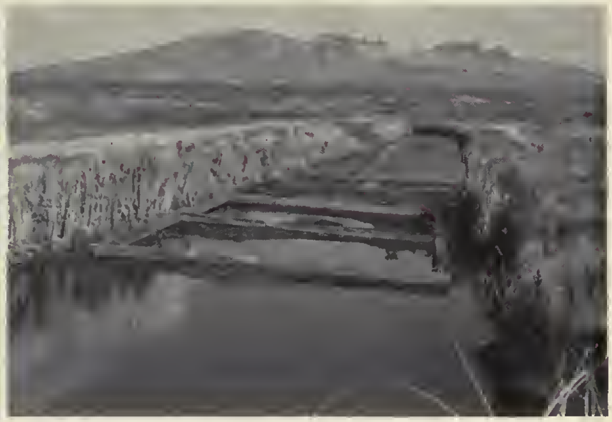
Following the adaptation and successful use the "moss fork," as it is locally termed, it becau evident that a better method of ponding the mo for the truck crane would be needed than to it pile up at structures. Floating booms, me fencing, trash racks patterned after pumpi plant grates, and other methods and devices we tried out.

The most successful one, locally termed a "mo trap," consists of two 30-foot power or telepho poles or large timbers placed parallel to each other and three 4 by 12-inch timbers bolted crosswise, one at each end and the third in the middle, thus forming two stilling ponds. The length of the 4 by 12-inch cross timbers depends on the width of the ditch. These traps are placed in the ditch at points readily accessible to the truck crane and are held in place by cables.

As the pond weeds are torn loose by chaining and float downstream, they lodge against the upstream cross timber of the trap. Some are forced under and lodge against the middle cross timber. Very little moss is found in the second stilling pond of the trap. The blanket of moss lodged against the trap has been a quarter of a mile long without seriously impeding the flow of water. When sufficient moss has been ponded the truck crane comes along and removes it with the moss fork. These traps are left in place throughout the year.

Annual savings to the project from the use of the moss fork and moss traps have been estimated to be about 10,000 man-hours of unskilled labor since only two men, crane operator and oiler, are required for the truck crane. The original cost of the moss fork purchased in 1950 was $653. The estimated cost for construction of each moss trap was $140. Twelve of these traps were placed in operation in 1952, each one more than paying for itself in savings of man power during the first irrigation season. ###

FLOATING LOG BOOM (lower left) directs weeds into trap and is used in wide channels. In channels, same with as trap (below), log boom is not necessary. ***Photos by M. D. Taylor, Jr., Region 2.***



Western Society of Soil Science Schedules Annual Meetings

The annual meetings of the Western Society of Soil Science are to be held at Santa Barbara, Calif., from June 15 to 17, inclusive, in conjunction with the meetings of the Pacific Division of the American Association for the Advancement of Science. The program includes an all-day field trip on June 15 to study the soils of the area; a general session on Tuesday morning, June 16, with an afternoon symposium on soil structure. Wednesday, the 17th, will be shared in a joint discussion with the American Society of Horticultural Sciences, followed by a general session of contributed papers in the afternoon. The annual banquet and business meeting will be held Wednesday evening, with Dr. L. A. Richards of the United States Salinity Laboratory, Riverside, Calif., as speaker. The papers on Thursday will deal largely on soil fertility problems with the possibility of additional talks on "Characterization and Reclamation of Alkaline and/or Saline Soils", "chlorosis," and "minor elements."

The society's officers are Maurice N. Langley, president; Dr. D. W. Thorne, Department of Agronomy, Utah State College, Logan, Utah, vice president; and Dr. Robert M. Hagan, Department of Irrigation, University of California, Davis, Calif., secretary-treasurer.

A condensation of papers presented at the annual banquet at Corvallis, Oreg., last year entitled "Nitrogen in the West" was carried in both the April and May issues of the Reclamation Era this year.

The society was incorrectly referred to in the April issue as the Western Soil Science Society instead of the Western Society of Soil Science.—Ed. #

RECLAMATION'S
HALL OF FAME

Nomination No. 1

LIN B. ORME

by WILLIAM J. WILLIAMS, Boulder City, Nevada, Region 3

Reclamation was as right as rain in the eyes of Lin B. Orme. And down in the Salt River Valley of Arizona during the long droughts when farmers despaired, Orme would lift their spirits with his famous assertion: "It will rain—it always has. All you've got to do is have faith."

Lin B. Orme had faith not only in the weather but in Reclamation. He was among the army of pioneer Westerners who fought for the Reclamation Act, passed in 1902. And long before the act was passed, he envisioned the Salt River Valley made great by a regulated water supply from Reclamation dams on the Salt and other rivers in the area.

He was one of the original incorporators of the Salt River Valley Water Users' Association in 1903. In the succeeding years until his retirement in 1948, he held every elective office in the Association, the agency which contracted with the Federal Government to repay the cost of Roosevelt Dam and other irrigation works to serve the valley. He was a member of the board of governors, was vice president from 1932 to 1934, and was president from 1934 until his retirement. He held the distinction of being the only president to be reelected without opposition. During his administration Bartlett and Horseshoe Dams, representing an investment of $10 million and an added water storage capacity of over 320,000 acre-feet were constructed on the Verde River.

Bartlett Dam on the Verde River near Phoenix, Ariz., shown here under construction, was built during Lin B. Orme's administration as president of the Salt River Valley Water Users' Association.

Orme (wearing tie) is shown here at dam site on September 22, 1938, with Bureau of Reclamation engineers and Association members.

Orme's uncle, John P. Orme, was president of the Association from 1910 to 1918. And carrying on in the family tradition of serving the West's natural resources interests, his nephew, Orme Lewis, is at present Assistant Secretary of the Interior.

Orme was born in Springfield, Mo., in October 1872, and with his parents moved to the Salt River Valley 7 years later. When death came to him at the age of 80 last March 26, he was still maintaining his home on the fertile 160-acre farm 8 miles west of Phoenix where he had lived since 1897. His son, Lin H. Orme, is a prominent attorney in Phoenix.

This writer spent an afternoon with Orme, recently, at his comfortable old-fashioned home. Surrounded by beautiful trees and flower gardens, the home revealed his artistry and good taste as well as those of Mrs. Orme, who passed away 4 years ago. Amid stacks of old pictures and newspaper clippings, the writer and this great pioneer traced the history of the Salt River Valley, so similar to that of other Western Reclamation areas. There were the good and bad years—the droughts and the floods. And then came the dams with their familiar results.

Orme was proud of his reputation as the valley's foremost rain prophet. In the summer of 1951, when the reservoirs behind Roosevelt and other project dams were almost dry, and when irrigators were wondering where the next drop of rain was coming from, Orme forecast rain. He went on the theory that the valley had a wet cycle every 10 years. And sure enough, in August that year the heavens opened up on the watershed and put water in the reservoirs to save thousands of acres of crops that otherwise would have perished.

One of Orme's proudest possessions was a colored picture of water spilling over Roosevelt Dam, which hung on his dining room wall. The picture was presented to him in 1941 by valley residents who were elated that Orme's rain forecast that year had come true. The picture was mounted in a large frame behind glass and across the top was printed this declaration: "It will rain, it always has."—Lin B. Orme. ###

LIGHT, FREQUENT IRRIGATION, providing fairly constant moisture to soil, can bring about top water efficiency and higher quality potatoes. *Photo by Phil Merritt, Region 1.*

LIGHT, FREQUENT IRRIGATION BEST

by GILBERT L. COREY, Assistant Irrigationist
University of Idaho Agricultural Experiment Station

Idaho Study Indicates That Keeping Soil Moisture Up Boosts Both Yield and Quality of Potatoes

Watch moisture in the soil—not the calendar—for the signal on when to irrigate. When you do, you will irrigate lightly and frequently, which is the way to get most value from the water. That was one of the important recommendations coming out of a 2-year study at the University of Idaho's Aberdeen Branch Station, in the heart of one of the State's major commercial potato-producing areas.

The objective of these studies was to determine what irrigation practice would produce the greatest yield of high-quality potatoes. Potatoes grown were Russet Burbank, Idaho's principal variety. One set of treatments (plots) was irrigated when available moisture was 30 percent depleted, another when it was 70 percent depleted, another when it was 85 percent depleted, while a fourth set was allowed to dry out until the plants showed marked visible moisture stress. Both sprinkler and furrow irrigation methods were compared.

Here is the general roundup of recommendations coming out of this study:

1. Do not wait too long after planting before the first irrigation. In general, this irrigation should come before the plants are 30 days old. The experiment shows no harmful effects by a little over-irrigation at this time, while insufficient irrigation early in the season causes a reduction in yield and quality.

2. Irrigate the crop frequently with light applications during the hottest part of the season to keep the soil cooler. Light applications are advised because no benefits were shown by irrigating with heavy applications. Heavy applications show only a waste of water.

3. Tubers with constrictions are formed during the hot part of the summer. If the soil is kept cool and at a uniform moisture, good quality tubers will result.

4. The potatoes need not be irrigated as often in August after the days have become shorter and cooler.

The penalty for delaying irrigation until the soil moisture was 70 percent gone in the top 10 inches of the soil was particularly severe. The 2 years of data collected at Aberdeen indicate the grower can expect any or all of the following unfavorable developments by such irrigation:

PLEASE TURN TO PAGE 127

CONSTRUCTION BEGUN ON VERMEJO PROJECT

Sixty-five years after the first attempt at irrigation by private capital the farmers of Colfax County, N. Mex., near the village of Maxwell, have a new Federal reclamation project underway. It is the Vermejo project.

The Colfax pioneers in 1888 built an irrigation system which they hoped would be capable of supplying water to 15,000 acres of land. Over the years it developed that the works were capable of serving only 3,500 acres, and that the water supply for this acreage was inadequate. The storage capacity loss in the reservoir was caused by sedimentation. In addition to this problem there was general deterioration of the distribution system as well as the control structures. Because the water supply was so short of the amount anticipated, farmers could no longer make a living from agriculture. They had to seek other employment, often far from home.

Determined to save their community, the people of Colfax appealed to their leaders in Congress The Congress requested the Bureau of Reclamation to find out what, if any, help the farmers could get in the way of repairing the irrigation works, under the reclamation law.

Bureau of Reclamation engineers made an investigation of conditions in the area and submitted their report to the Congress. The Congress in turn authorized the Vermejo project by the act of September 27, 1950, as amended by the act of March 5, 1952.

Under the terms of the repayment contract between the United States and the Vermejo Conservancy District the farmers will repay the costs of rebuilding their project. The project plan, as authorized by Congress, provides for enlarging and repairing three reservoirs, and repairing an existing diversion dam, canals, laterals, and drains. These facilities will provide a safe irrigation water supply for 7,200 acres, 3,500 of which were previously receiving a short supply of water.

Early last April the people of Colfax County had real cause to celebrate when Director of Operation and Maintenance Division, E. D. Eaton, turned the first shovel of earth, near the old Stubblefield Dam, symbolizing the beginning of construction. Within seconds after he presented the gold-plated shovel, used for the ceremony, to R. T. Lingle, engineer for the Vermejo Conservancy District, huge tractors and bulldozers began moving mountains of earth to Stubblefield Dam, one of three in line for repairs. Approximately 1,200 persons attended the celebration, which was arranged and conducted entirely by the Vermejo Conservancy District Board of Directors.

AT VERMEJO CELEBRATION, sponsored by the Directors of the Vermejo Conservancy District, E. D. Eaton, Director of Reclamation's Operation and Maintenance Division addresses the crowd on the site of old Stubblefield Dam. *Photo by F. S. Finch, Region 5.*

Among the distinguished guests present were United States Senator Clinton P. Anderson, who addressed the celebrants; Oscar Love, Middle Rio Grande Conservancy District Board; John P. Murray, Middle Rio Grande Flood Control Association; Robert Tripp, Albuquerque Chamber of Commerce; Berl Huffman, Albuquerque Chamber of Commerce; leading reclamationists Harry Tellyer, of Albuquerque, and Ed Foster of Farmington, N. Mex.; F. M. Rutherford, C. R. Miller, J. C. Matthews, Hugh F. Littrell, and Joe Pompeo of the Vermejo Conservancy District Board of Directors. #

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If you have friends or associates who would be interested in the Reclamation Era, please send their names and addresses to the Bureau of Reclamation, Washington 25, D. C. We shall be glad to send them copies of back issues.

Like to be a FROG FARMER

by B. BRUCE BARNUM, Agricultural Aide, Sacramento Valley District, Chico, California, Region 2

Frank Ondricek, owner of the Orland Variety Store, is celebrating the third anniversary of his favorite spare time project—frog farming.

Located $4\frac{1}{4}$ miles northeast of Orland on Summit Avenue, Mr. Ondricek's frog farm is a unique enterprise among the diversified operations on the Orland Reclamation project of northern California.

Stimulated by an almost insatiable market for frogs and an unlimited capacity for outdoor work, Mr. Ondricek began construction of his frog-breeding ponds in March 1951. Although nearly 4 years are required to raise frogs to top size, Mr. Ondricek expects to market around 500 frogs this season.

Mr. Ondricek's frog farm occupies an area 120 by 150 feet and is enclosed by a 5-foot wire mesh fence. Within the enclosure, an electrically charged wire at the top and a sheet metal strip, extending 15 inches into the ground at the base, keep the frogs in and the predators out.

Within the enclosure lie a series of shallow, parallel ponds, each approximately 14 by 105 feet, separated by wood fencing but connected by water pipes to permit an exchange of water. All the ponds have been made seepage-proof with tamped clay linings except one central seepage pool which collects overflow from the other ponds.

Pond depth averages 36 inches, except for a 4-foot deep silt-filled pit in the center which provides space for the frogs to hibernate during winter months. Water weeds are grown in the pools to oxygenate the water and to provide protective cover for the frogs. The mosquito hazard is easily controlled by introducing mosquito fish which feed on the mosquito larvae. The fish multiply rapidly and provide an important part of the frogs' diet

"I got my original stock of frogs from stream near here," explained Mr. Ondricek, "although th breed, trade named Nufond Giant, originall came from the Southern States, notably Louisiana Both bull frogs and green frogs grown here attai good size. The bull frog is larger, scaling fron 3 to $3\frac{1}{2}$ pounds at maturity. Males and female are about the same size but are distinguished b larger ear disks in the male. The male is the voca member of the pair."

Characteristic of lower forms of animal life, th frog has an intermediate body form which it re tains for a period ranging from 4 months to years. In this intermediate stage the frog stay submerged in the water, breathes by means of gill and swims around by whipping its long, flesh tail and behaves generally like a fish. Graduall its tail disappears and he is transformed into true amphibian—at home in the water or on land

Mr. Ondricek explained that two of his pond are used for breeding ponds. Here, eggs are de posited by the females and fertilized by the male Floating on or near the surface of the water, th eggs are collected and transferred to the tadpol ponds where they can safely hatch and develo through the tadpole stage into small frogs.

"Feeding my frogs is a more complicate process than you might think," said Mr. Ondrice "Both tadpoles and frogs are heavy eater Naturally both are capable of securing a certai amount of food for themselves. Those light above the ponds go on automatically at night t draw flies and other insects to the pond area My frogs feed heavily upon them. However, t speed up their growth in size and weight an improve the quality of their meat, supplementary feeding is important."

Tadpole feeding is relatively simple, for they will eat "still" food. Ground liver and spleen, chicken mash, even bread and cottage cheese placed in the pool are acceptable.

Frog feeding is a different story. They must have "live" food—practically anything of reasonable size that moves will be snapped up. To feed his many frogs, Mr. Ondricek has devised a simple but very effective system of mass feeding-bait lines. Small link chains, two to a pond, are strung the length of the ponds and several feet above the water. The ends of the chains extend outside the pond enclosures and are fixed to a cable running around two sides of the frog yard. A slow-geared electric motor, located at one end of the cable, imparts a reciprocating motion to the cable and, in turn, to the chains over the ponds. Tension as well as freedom of movement for the cable is accomplished by coiled spring mountings at the end and corner posts. The frogs flick the feed from the wires with their long tongues.

Bits of liver and spleen are loosely fastened to the ends of fine copper wires hung at 6-inch intervals along the bait lines and allowed to dangle just above the pond surface.

"We feed the frogs daily during summer months," Mr. Ondricek explained. "The wires are baited by hand and takes less time than you might think. When we finish, all we do is take off our wading boots, go to the motor and throw the switch. Those fellows never miss a meal!"

Although only the legs are commonly served for food, the whole dressed carcass is sold to the dealers. Premium size frogs run over 3 pounds but 2-pound frogs are considered to be of butchering size.

###

FROG FARMER ONDRICEK displays one of his ready-to-market product in above photo. Frog weighs between 2½ to 3 pounds and is 12 inches long. Specimens are frequently larger than this one. Below—view of the breeding pond. ***Photos by the author.***

Fertilizer + Irrigation = Time Saving

(The following article is based on information contained in the publication, Distributing Fertilizer Through Irrigation Systems, prepared by the Portland (Oreg.) General Electric Co.)

A good way to do two jobs at once and save time and effort in the bargain is to apply fertilizer at the same time you irrigate.

If you irrigate with a sprinkler system, it's easily done by dissolving soluble fertilizers in water and applying the solution through your system. Requiring only a minimum of equipment and only a fraction of the effort involved in applying fertilizer mechanically, sprinkler irrigation-fertilizing is attracting more farmers all the time.

You can regulate the penetration of the fertilizer into the soil by controlling the time of fertilizer application in relation to the total irrigation period. Generally, it is best to apply the fertilizer within two hours of the end of the run, in 15 or 20 minutes time. Water passing through the system after the fertilizer is shut off cleans the lines and sprinklers, and carries the fertilizer into the top few inches of soil. Applying the fertilizer earlier during the sprinkling, will cause it to pentrate the soil more deeply. Experience will soon show the best method for your particular crop and conditions.

The fertilizer can be dissolved in water in a container such as a barrel, in the approximate ratio of 1 pound of fertilizer per gallon of water. The barrel or other container should be located adjacent to the irrigation pump for convenience in adding the fertilizer solution to the irrigation water. The method of doing this will vary with the type of pump being used for irrigation.

Addition of fertilizers in solution to centrifugal pump irrigation systems is relatively simple. All that is needed is a pipe extending from near the bottom of the fertilizer container to the suction pipe of the pump, with a shut-off valve at a convenient point between.

Another pipe from the discharge side of the pump to the fertilizer container provides an easy method of filling it with water for dissolving the fertilizer, and rinsing it afterward. A hose is sometimes used instead of a pipe where flexibility is desired.

A diagram illustrating a typical set-up is shown in FIGURE 1.

On an irrigation system using a turbine pump, the liquid fertilizer must be introduced into the irrigation water under pressure exceeding that of the discharge at the pump. One method of accomplishing this is to use a small motor-driven gear or paddle pump.

The hook-up is shown in FIGURE 2.

To avoid corrosion after the fertilizer solution is pumped into the line, it is well to refill the barrel with water and run it through the pump, repeat-

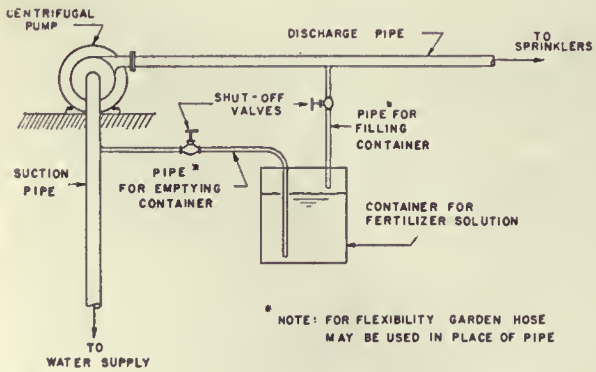

FIGURE 1

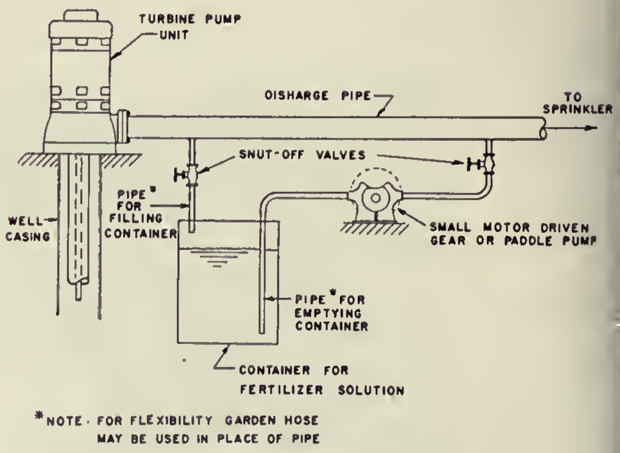

FIGURE 2

ing the operation several times to rinse the pump and barrel thoroughly.

Fertilizers in solution may be introduced into irrigation water with the aid of an aspirator or jet unit. A portion of the water discharged from the pump is bypassed through the aspirator, creating suction that will draw the fertilizer solution into the line. The hook-up is illustrated in FIGURE 3.

It is essential to have valves for regulating the relative flow through the aspirator and the main line. The cost of the valves, plus the necessary pipe fittings and aspirator unit may make this system as expensive as a small gear or paddle pump unit, or even more so. However, it has the advantages of simplicity and freedom from moving parts. It should be noted that operating the valves in connection with the venturi reduces the pressure at the last sprinkler if the system is underdesigned or underpowered. The result is the application of the fertilizer in an uneven pattern.

The amount of fertilizer to apply during each lateral setting can be determined easily from the table below. In the right-hand column of the table, the amount of fertilizer to apply for an application rate of 100 pounds per acre, with 60-foot lateral settings, is indicated. Lesser or greater rates of application can be calculated from these figures, as shown in the example following the table.

QUANTITY OF FERTILIZER REQUIRED PER LATERAL SETTING

Lateral length in feet	*Number of sprinklers (at 40 foot spacing)*	*Area covered per 60 foot setting, in acres*	*Quantity to apply per setting, for rate of 100 pounds per acre*
			Pounds
160	4	0.22	22
200	5	.28	28
240	6	.33	33
280	7	.39	39
320	8	.44	44
360	9	.50	50
400	10	.55	55
440	11	.61	61
480	12	.66	66
520	13	.72	72
560	14	.78	78
600	15	.83	83
640	16	.89	89
680	17	.95	95
720	18	1.00	100
760	19	1.05	105
800	20	1.10	110
840	21	1.16	116
880	22	1.21	121
920	23	1.27	127
960	24	1.32	132
1,000	25	1.38	138

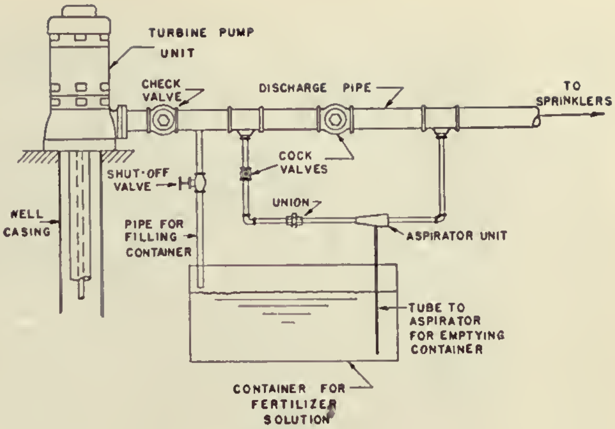

FIGURE 3

For example, an operator wishes to apply fertilizer at the rate of 300 pounds per acre. He is operating 400 feet of lateral, and moves it 60 feet along the main line at each setting. How many pounds of fertilizer should he apply at each setting of the lateral?

Referring to the quantity column at the right side of the table, opposite a lateral length of 400 feet we find that 55 pounds of fertilizer must be applied per setting, to apply it at the rate of 100 pounds per acre. Multiplying 55 by 3, we obtain 165 pounds as the quantity of fertilizer to apply at each setting of the lateral, for an application rate of 300 pounds per acre.

To obtain the quantity required for lateral moves other than 60 feet, multiply the quantity figure in the previous table by a correction factor, as follows:

Lateral moves along main, in feet	Correction factor	Lateral moves along main, in feet	Correction factor
30	0.500	80	1.330
40	.667	100	1.667
50	.835		

For example, assume that an operator is making 50-foot moves of the lateral along the main line. He has 960 feet of lateral and wishes to apply fertilizer at a rate of 400 pounds per acre.

From the table we find that with 60-foot moves, 960 feet of lateral requires 132 pounds of fertilizer per setting. Multiplying 132 by 0.835 (the correction factor for 50-foot moves) gives 110 pounds per setting. Multiplying 110 by 4 gives 440 pounds as the quantity of fertilizer to be applied at each setting of the lateral, to apply it at the rate of 400 pounds per acre. ###

RECLAMATION'S "IRRIGATION LABORATORIES"

SOY BEANS, above left, yield 53 bushels per acre under irrigation. Immediate left, beef cattle on the irrigated alfalfa-brome pasture of the Huron Farm. Gains of 476 pounds of beef per acre were realized during season. *Photo by C. A. Knell, Region 6.*

With the future possibility of having controlled water on 750,000 to 1,000,000 acres of land in the James River Valley of South Dakota, the Bureau of Reclamation, South Dakota State College Agricultural Experiment Station and the Bureau of Plant Industry, Soils and Agricultural Engineering, are gathering information on irrigation agriculture in this area prior to bringing irrigation water into the James River Valley from the Missouri River.

The laboratories for this work are two development farms established by Bureau of Reclamation. One is located 6 miles east of Redfield and the other 4 miles southeast of Huron, both of which are in the James River Valley of South Dakota. Each of these farms has approximately 130 acres of irrigated land. The irrigation water is pumped to the high point on each farm from the James River by electrically powered pumps. The Redfield Development Farm is located in the Dakota Lake Plain on Beotia or Bearden silt loam. The Huron Development Farm is on a Barnes loam soil. Both of these soils series are common to a large portion of the James River Valley.

The development of the Oahe Unit in South Dakota by the Bureau of Reclamation was ap

PRIZE SIZE cabbages grown on Redfield Development Farm, immediate right. The yield per acre is 23 tons. Photo below shows size of cauliflower grown on the same farm, worth a yield of 9 tons per acre.

proved by the Congress in the Flood Control Act of 1944. As a part of this program, these farms, under actual field conditions, will provide basic data required for the future irrigation development of this proposed Oahe Unit. These data will include information on cropping practices, crop varieties adapted to irrigation in the area, yields that may be anticipated under irrigation, practical methods of water application, water requirements for irrigated crop production, and the effects of irrigation on the soils represented by the farms.

A third development farm, or working laboratory in the Bureau's Missouri-Oahe District, is in its second year of production and is located on the Shadehill Unit of the Grand River near Lemmon, S. Dak. This farm contains 35 acres and the water is supplied by an electrically powered pump from the reservoir back of the Shadehill Dam. The Shadehill Development Farm was planned and developed for the purpose of testing the reaction of respective soils of the proposed project lands to sustained application of high-sodium water, and to determine, if possible, a suitable method of counteraction by the use of soil amendments and leaching, whereby adequate internal drainage may be maintained for long-time irrigated crop production.

Each year thousands of farmers, businessmen, and other interested persons, visit these farms in regular, organized tours. Individuals and groups visit the farms nearly every day throughout the crop-growing season. One of the statements most frequently heard by these observers is "this coming irrigation in the James River Valley should go a long way in stabilizing the agriculture of South Dakota."

It is believed that the visitors realize the many changes that will take place in the transition from dry land to irrigated farming. Many feel that the cropping pattern will gradually change from wheat and other small grains to a much larger production of alfalfa, pasture, soybeans, corn, potatoes, and sugar beets, and possibly to considerable truck gardening as well as increase livestock production. They also know that this will mean much additional agricultural industry, such as canneries, beet sugar factories, alfalfa dehydrating plants, additional creameries, packing plants, etc. Also, this will mean a change in the size of the farm from its present average of 500 acres per operator to much smaller units under irrigation, all of which will provide better support and greater stability to a larger population in the rural and urban areas.

The average precipitation at the Redfield farm during 1948–52, inclusive, was 13.46 inches during the growing season (April 1 to October 31). In

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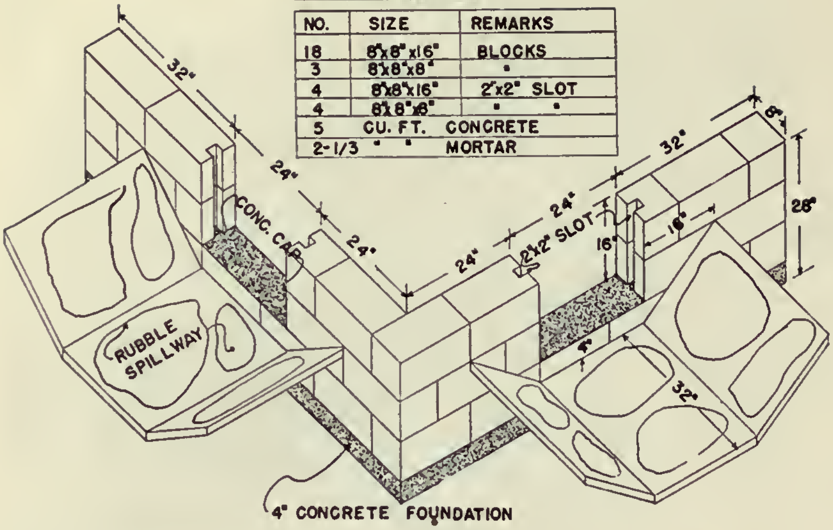
BILL OF MATERIALS

NO.	SIZE	REMARKS
18	8"x8"x16"	BLOCKS
3	8"x8"x8"	"
4	8"x8"x16"	2"x2" SLOT
4	8"x8"x8"	" "
5	CU. FT.	CONCRETE
2-1/3	" "	MORTAR



At left 2-Way Diversian-Concrete Block. On the next page is anather type of 2-Way Diversian-Cancrete Block as well as a 3-Way Diversion-Concrete Black. *All illustrations in this article are caurtesy of the Agricultural Extension Service, University of Wyoming, Loromie, Wyo.*

LOW COST IRRIGATION STRUCTURES

(First of a series of three articles based on information contained in Circular 122, a publication of the University of Wyoming, Extension Service, Laramie, Wyo.)

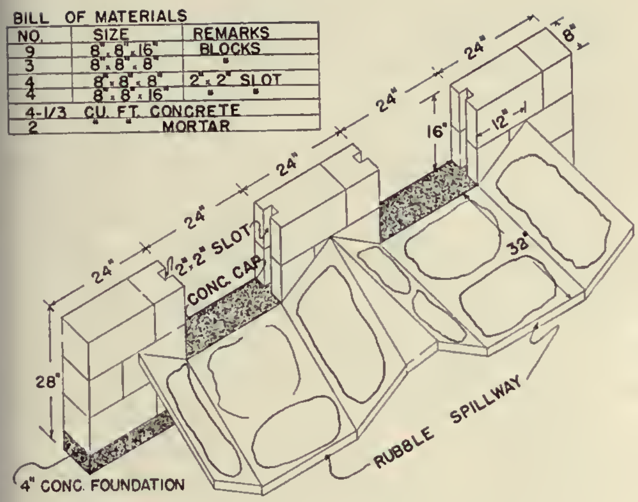
One of the wisest investments an irrigator can make is in durable, efficient control structures. Properly placed and correctly used, they can reduce time-consuming labor, save soil, conserve precious water, and permit the farmer to leave the water unattended and not have to worry about washouts.

"But such control works are expensive—they take time to build," you say? Actually they're a lot less expensive than you might think. Irrigation structures that once cost up to $150 for a single concrete installation can now be built by the average farmer for from $40 down to less than $20, thanks to recent experimentation by irrigation farmers and researchers.

Typical of the durable, efficient structures recently developed and proven through operation is the 2- or 3-way concrete block diversion structure. The diversion of water from a single ditch into 2 or more ditches is a "must" for good water control. Often this vital diversion is performed by the farmer skillfully manipulating his shovel. Although such shovel work forms an important part of the tradition of irrigation farming, a concrete block structure can do the job better while saving time, labor, and preventing waste of water.

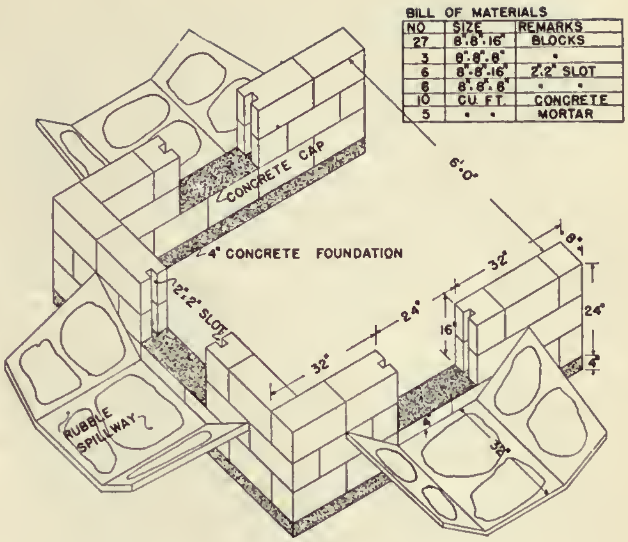
A 4-inch concrete foundation is the first step in constructing the diversion. Care must be taken to be certain that the foundation is fairly level on top. The first row of 8- by 16-inch concrete blocks is placed on the fresh concrete, making sure that a good bond is formed. Another row of blocks is then mortared in, and a concrete cap is placed on top of the blocks forming the bottom of the diversion opening. Facing the diversion opening are blocks with a 2-inch square groove to accommodate the check board. Of course, height and arrangement of diversion openings can be easily adjusted to meet specific needs. Depending on the locality, the grooved blocks may have to be specially ordered. Rubble or concrete spillways should be provided on the down-face of the diversion to eliminate the danger of soil erosion around the diversion.

The blocks used should be of dense concrete, not the lightweight type. For best results, it is recommended that all concrete mixes be 1 to 2¾ to 4 (volumes of cement-sand-gravel), with a water-cement ratio of 5½ gallons per sack of cement.



BILL OF MATERIALS

NO.	SIZE	REMARKS
9	8"x8"x16"	BLOCKS
3	8"x8"x8"	"
4	8"x8"x8"	2"x2" SLOT
4	8"x8"x16"	" "
4-1/3	CU. FT. CONCRETE	
2	" "	MORTAR



BILL OF MATERIALS

NO	SIZE	REMARKS
27	8"x8"x16"	BLOCKS
3	8"x8"x8"	"
6	8"x8"x16"	2"x2" SLOT
6	8"x8"x8"	" "
10	CU. FT.	CONCRETE
5	" "	MORTAR

Mortar mixes should be 1 to 2½ (volume of cement to volume of sand), or 1 to 1 to 5 for cement, hydrated lime, and sand mix.

If the materials are handy, the structure can be put up in a half day. The cost of materials will vary, depending on locality, but will probably be around $20 for the 3-diversion structure illustrated here. The 2-way diversion should be correspondingly less.

When lumber is used in construction of the structures, it is recommended that it be preservative-treated.

Design and arrangement of the diversions, of course, can be varied so that they will divert water into ditches meeting at an angle, create combination diversions and drops, or meet any other special needs of the farm's distribution system. ###

Ground-Water Data In Columbia Basin Project, Washington, Released

Irrigation of a portion of the 1 million-acre Columbia Basin Project with water pumped from the Columbia River, started in 1952, and its possible effects on the water table make information on ground-water conditions in the area increasingly important, Secretary of the Interior Douglas McKay recently stated.

Ground water is almost the sole source of supply in the area for domestic, municipal, and industrial use, and large amounts have been used for irrigation according to a recent Geological Survey report on ground-water conditions and resources in the area.

The report entitled "Progress report on ground water in the Columbia Basin Project, Wash.," was prepared by M. J. Mundorff, D. J. Reis, and J. R. Strand. It can be examined at Geological Survey offices, 2128 South 38th Street and 207 Federal Building, Tacoma, Wash.; and 2209 General Services Building, Washington 25, D. C.; at the Division of Water Resources, Transportation Building, Olympia, Wash.; the Bureau of Reclamation, Ephrata, Wash.; and the public libraries of Seattle, Spokane, and Ephrata. •

Contract Awarded for Sly Park, California, Dam

A Bureau of Reclamation contract for construction of Sly Park Dam near Camino, El Dorado County, Calif., as part of the Sly Park Unit of the Central Valley Reclamation project, has been awarded to Frederickson & Watson Co. and M & K Corp., Oakland, Calif.

The 190-foot high, 760-foot-long earth-fill dam and 600-foot long dike will create a 41,000 acre-foot capacity storage reservoir for presently uncontrolled flows of Sly Park and Camp Creek waters needed for irrigation, domestic, and industrial purposes in Placerville, Camino, and surrounding areas. •

Reclamation's Laboratories

CONTINUED FROM PAGE 123

comparing irrigated to dry-land yields in this area (dry-land yields taken from South Dakota Crop and Livestock Reporting Service), corn yielded, 375 percent; alfalfa, 333 percent; and potatoes, 503 percent through irrigation over yields from dry-land farming.

Redfield Development Farm Crop History from 1950 through 1952

	Alfalfa (tons)		Corn (bushels)		Oats (bushels)		Barley (bushels)		Potatoes (bushels)		Beets (tons irrigated)
	Irrigated	Dry	Irrigated	Dry	Irrigated	Dry	Irrigated	Dry	Irrigated	Dry	
1950	4.0	1.4	60.0	22.0	53.5	19.0	53.6	14.0	500	95	22
1951	4.6	1.6	95.4	18.0	71.3	39.0	51.2	26.0	536	110	30
1952	6.3	1.6	88.6	25.0	-----	16.0	26.7	8.0	510	-----	25
Average	5.0	1.5	81.5	21.7	62.4	24.7	43.8	16.0	515.3	102.5	25.7

Redfield Development Farm Irrigated Truck Crops 1951

[Year of greatest diversification]

Truck crop	Tons per acre	Truck crop	Tons per acre	Truck crop	Tons per acre
Cabbage	23.06	Lettuce	21.78	Peppers	9.07
Cauliflower	9.06	Cucumbers	16.63	Sweet corn	3.0
Broccoli	3.86	Squash	16.29	Tomatoes	16.24

The Huron Development Farm has been operating primarily as a livestock unit and for the production of variety feeds, including corn, small grains, grasses, and legumes. Irrigated pastures are used by livestock on an experimental basis by South Dakota State Agricultural College.

Huron Development Farm Pasture Trials, Irrigated and Native

[120-day period]

	Irrigated alfalfa-brome pounds of beef gain/acre	Dry land native pounds of beef gain/acre		Irrigated alfalfa-brome pounds of beef gain/acre	Dry land native pounds of beef gain/acre
1948	---------	99	1951	375	134
1949	400	90	1952	476	71
1950	354	92	Average	401.2	97.3

Information regarding proven practices and crops under research will be used in the future as part of the recommendations to farmer-irrigators in the area as based on findings of agricultural research in these field laboratories under the cooperative supervision of South Dakota State College Experiment Station, the Department of Agriculture, and the Bureau of Reclamation. ###

Protect Your Fence Posts

Should you treat your fence posts? The answer will probably be "Yes" for most farmers, for thousands of dollars are spent each year to replace rotted fence posts. The proper preservative applied to these posts could have saved countless dollars and added years to the usefulness of the posts.

Careful research should be done in selection of the post and preservative. For example, untreated locust, oak, and cedar resist decay and termites longer than softer woods. Proper selection of the best available native wood and correct treatment should give longer lasting posts plus adequate protection of crops and livestock for many years.

Cutting time, seasoning, treatment and even peeling have advantages to be considered.

For instance, the bark peels best in the spring and early summer, but seasoning in the summer is likely to be so rapid that it may result in severe checking. Wood cut during hot weather and carelessly piled may become infected by insects and wood rotting fungi. Wood cut during winter is not subject to insects, and if peeled, usually is dry enough by warm weather to avoid decay or rot.

Seasoning would be correctly done if the logs are piled so the air can circulate freely through them. If the posts are raised at least a foot above the ground and not close-piled or allowed to lie or stand on the ground before treatment decay will not start before they are seasoned. No method of piling is satisfactory that permits any part of the post to rest on the ground.

For further information on this subject, the Department of Agriculture has issued a new Farmers Bulletin, No. 2049, entitled "Preservative Treatment of Fence Posts and Farm Timbers," which may be obtained free by writing to the Department of Agriculture, Washington, D. C. #

HAVE YOU CHANGED YOUR ADDRESS LATELY? GOING TO MOVE SOON?

Let us know immediately so we can change our mailing list—it takes time, you know.

We'll do our best to deliver the RECLAMATION ERA to your correct address, but we have to know what it is.

Light, Frequent Irrigation Best

CONTINUED FROM PAGE 116

1. The total yield and yield of No. 1's will be decreased.
2. The yield of bottleneck and pointed-end tubers will be increased.
3. The yield of undersized tubers will be increased.
4. The top weight of the vines will be decreased.
5. There will be a loss of russetting on the tubers.
6. The soil temperature will be higher.

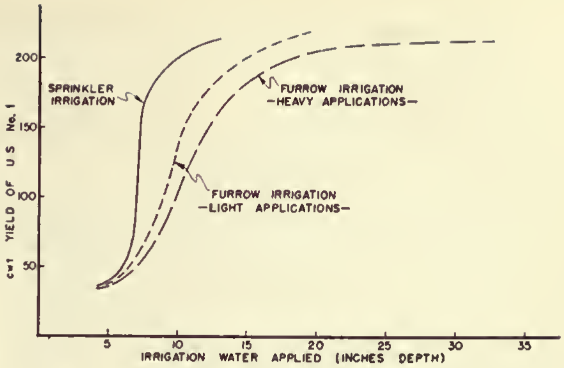
Below are some other general indications from the experiments:

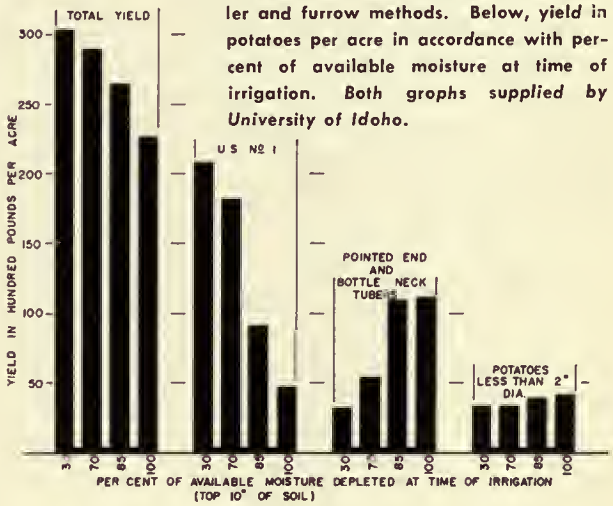
1. The yield of knobby tubers is not affected by irrigation.
2. Specific gravity (density or weight per unit volume) of the tubers is not affected by irrigation.
3. Growth cracks are increased by heavy irrigation.
4. The number of tubers per plant and the depth of tuber set is not affected by irrigation.
5. The higher the soil temperature, the higher the yield of pointed-end and bottleneck tubers.

It was also found that irrigation has little effect on the severity of the early dying disease, prevalent in the area. This is a disease that kills the vines early in the season, before the tubers reach maturity. Little is known about the disease, including the cause of it. Some believe it is a soil-borne virus. Delaying the first irrigation will delay the onset of the disease; however, once the disease does start after a delayed first irrigation, its progress is vary rapid and the plants are soon completely dead.

Sprinklers showed a tremendous saving in water over furrow irrigation in the Aberdeen experiment. To maintain equal soil moisture content in the upper 10 inches of soil about one-half as much water was needed with the sprinkler system.

The importance of soil temperature in the production of good quality potatoes was shown. There was a definite increase in the amount of pointed-end and bottleneck tubers with the warmer soil temperatures during July. Sprinkler plots were not significantly cooler than furrow-irrigated plots, but plots which were irrigated most frequently remained cooler throughout the growing season. ###





Above, comparison of irrigation by sprinkler and furrow methods. Below, yield in potatoes per acre in accordance with per cent of available moisture at time of irrigation. Both graphs supplied by University of Idaho.

Savage Rapids Dam Rehabilitation Under Way

Emergency repair work has been started on Savage Rapids Dam on the Rogue River near Grants Pass, southwestern Oregon. The Bureau of Reclamation awarded the contract to the Young and Smith Construction Company, Salt Lake City, Utah.

Under the contract award, the spillway gate system at the dam will be rebuilt, the spillway apron repaired, and other improvements made in the vicinity of the dam to assure the safety and efficient operation of the water diversion structure.

New Map of Irrigated Lands

The Bureau of the Census has just completed a new map showing irrigated lands in the 17 Western States, Arkansas, and Florida. It is 34 x 41½ inches and may be purchased from the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C., for 35 cents.

LETTERS

Gopher Articles Helpful

MARCH 6, 1953.

DEAR SIR:

Some time ago you published a very interesting article in the RECLAMATION ERA pertaining to the eradication of gophers.

Apparently we have lost or loaned this issue, which we considered very valuable. We would be very grateful to you if you could obtain this issue, or a copy of this article and forward it to us.

We have had a number of inquiries regarding this article and we are of the opinion that this will be most beneficial.

Yours very truly,

E. O. DAGGETT, *Manager,*
Farmers Irrigation District,
Scottsbluff, Neb.

We were pleased to send Mr. Daggett copies of the articles "Gassing the Gophers" and "Gas Chamber for Gophers" which appeared in the September 1951 and February 1952 issues of the RECLAMATION ERA.—Acting Ed.

They Read It Around the Globe

MSA. APO 206-A
% Postmaster
NEW YORK, N. Y.
March 1, 1953.

DEAR SIR:

From the address given above you could not tell that I am now living in Ankara, Turkey, and working through this country as a member of the Agricultural Advisory Commission to the Turkish Ministry of Agriculture. We use the above address because mail will then go for the United States domestic rate.

Today begins our eleventh month in Turkey, or in other words we arrived here just 10 months ago today. We were in Washington for 10 days before coming over but they kept me too busy to get around.

Guess I better call attention to the enclosed slip, and my check for $2.00 to keep the ERA coming for the next 2 years. We expect to return to the United States when our 2 years are up. I want to tell you how much I appreciate receiving the ERA. Just last week I was laid up for a couple of days with the flu, and caught up with reading them. They are good.

Sincerely yours,

RALPH E. JOHNSTON.

RELEASES

Hoover Dam Folder

An illustrated folder (revised) wa recently released by the Bureau Reclamation entitled "Hoover Dam A limited supply is available free charge from the Bureau of Reclam tion, Supply Field Division, Attenti 841, Building 53, Denver Federal Ce ter, Denver 2, Colo. ●

Magic Water

The latest illustrated folder on th Columbia Basin which was releas recently is entitled "Magic Water f the Columbia Basin Project." Copi may be had free of charge by requestin them from the Bureau of Reclamatio Supply Field Division, Attention 84 Building 53, Denver Federal Cent Denver 2, Colo. ●

DO YOU KNOW . . . .

● To ship all the citrus and veg tables that are produced each year the Lower Rio Grande Valley, Texa by rail in a single train, it would r quire a line of railroad cars 600 mil in length or roughly the distance fro New York to Toledo, Ohio?

NOTES FOR CONTRACTORS

Contracts Awarded During April 1953

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contn amou
DS-3870	Missouri River Basin, S. Dak.	Apr. 9	One 69,000-volt voltage-regulating transformer, rated 50,000/66,667-kilovolt-ampere output capacity, for Sioux City substation.	American Elin Corp., New York, N. Y.	$6[illegible]
DC-3887	Missouri River Basin, S. Dak.	Apr. 14	Second stage construction of Armour, Tyndall, and Woonsocket substations.	Lipsett, Inc., New York, N. Y	35,[illegible]
DC-3888	Central Valley, Calif	Apr. 17	Construction of Sly Park dam	Fredrickson & Watson Construction Co. and M & K Corp., Oakland, Calif.	2,716,[illegible]
DC-3896	Columbia Basin, Wash	Apr. 6	Installation of rubber joint strips in Grand Coulee right power plant.	Elbert L. Powell and R. L. Beasley, Coulee Dam, Wash.	20,[illegible]
DC-3897	Colorado-Big Thompson, Colo.	Apr. 7	Construction of earthwork, structures, and surfacing of Pole Hill access road, Flatiron section, Estes Park-Foothills power aqueduct.	Western Foundation Construction Co. and C. F. Stirn, Denver, Colo.	110,[illegible]
DC-3903	Columbia Basin, Wash	Apr. 24	Painting for Grand Coulee pumping plant, power plant, elevator towers, siphon breaker house, right switchyard service building, and right switchyard.	F. O. Repine Co., Salem, Oreg	25,[illegible]
DC-3905	do	do	Earth blanketing Potholes East canal	L. D. Shilling Co., Inc., Moses Lake, Wash.	233,[illegible]
DS-3939	Davis Dam, Ariz.-Calif.-Nev.	Apr. 3	Repair of field pole assemblies of synchronous condenser at Phoenix substation.	General Electric Co., Denver, Colo.	11,[illegible]
117C-184	Columbia Basin, Wash	Apr. 14	10-truck garage and equipment storage building at Royal O&M Headquarters.	United Industries, Inc., Richland, Wash.	12,[illegible]
117C-186	do	Apr. 21	Supplemental waterway, drain, and structures, areas P-1 and P-2.	McWaters & Bartlett, Boise, Idaho.	35,[illegible]
617C-34	Riverton, Wyo	Apr. 14	Open and closed drains in North Pavilion and North Portal areas.	Basel & Whitehead, Riverton, Wyo.	59,[illegible]
704C-275	Colorado-Big Thompson	Apr. 7	Construction of 13.8-kilovolt distribution and control lines in Foothills area.	Snowden Electric Co., Denver, Colo.	31,[illegible]

Construction and Materials for Which Bids Will Be Requested by August 1953

Project	Description of work or material
uma, Calif.	Placing a 1-inch plant-mix surfacing course over the full width of a portion of State Highway 150 to a total width of 20 feet. The work will include furnishing and placing 16 tons of asphaltic emulsion (paint binder) and 4,770 tons of plant-mix surfacing.
o	Construction of Goleta distribution system laterals 10 to 16 and pumping plant in lateral area 13–1, along U. S. Highway 101 between Goleta and Santa Barbara, Calif., requires furnishing and laying about 12 miles of 2- to 14-inch diameter steel pipeline and constructing a plant to house one 100 gallons per minute and three 200 gallons per minute pumps at 225-foot head, and install one pump of each size. The plant will have a steel air chamber with compressor for equalizing line pressures. About 11.5 miles of pipe 3 inches and over is to be mortar-lined. Laterals include pipe, fire hydrants, pressure reducing, air-and-vacuum relief and pressure-relief valves, all contractor-furnished, weighing about 430 tons.
tral Valley, lif.	Construction of 58 miles of 12- to 66-inch diameter reinforced concrete pipeline, monolithic concrete moss screens, and low-head pumping plants, valves, slide gates, miscellaneous metalwork, and electrical controls for Unit 1 of Delano-Earlimart Irrigation District distribution system, Friant-Kern Canal, located in Tulare county near Earlimart, Calif.
Do	Construction of 11 miles of 12- to 30-inch diameter concrete pipelines, including 12 gravity turnouts and 12 turnouts with pumping plants of 9 to 2 cubic feet per second capacities, for Plainview Water Irrigation District distribution system on the Delta-Mendota Canal, about 5 miles southwest of Tracy, Calif.
Do	Modifying gravity turnouts along Delta-Mendota Canal.
mbia Basin, h.	Construction of area P–4 laterals (Block 13), sublaterals, and wasteways, varying from 288 to 3 cubic feet per second capacities. Work consists of excavating 45.3 miles of unlined laterals and wasteways with base widths of 2 to 16 feet, 14.5 miles of pipeline from 12- to 60-inch culvert and pressure pipe, concrete structures, including division boxes, checks, weirs, culverts, drops, 7 small pumping plants, and 3 bridges.
Do	Placing floor finishes in a 4,200-square-yard area of Grand Coulee pumping plant at Coulee Dam, Wash., and installing 6,000 feet of base and 1,000 feet of curb.
Ariz	Construction of 26 miles of unreinforced concrete-lined laterals, 9 miles of wasteway channels, 3 jacked-pipe railroad siphons, and checks, drops, pipe road siphons, turnouts, bridges, deliveries, and wash siphons for Unit 2 of Wellton distribution system to irrigate about 7,700 acres surrounding Wellton, Ariz. Work includes furnishing
Gila, Ariz.—Con.	and laying about 1 mile of 30- to 54-inch diameter concrete pipe, about 360,000 cubic yards of lateral and structure excavation, and 400,000 cubic yards of channel and dike excavation.
Minidoka, Idaho	Drilling observation wells for North Side Pumping Division north of Rupert, Idaho.
Missouri River Basin, Kans.	Construction of 7 miles of unlined laterals and drains of 18 to 6 cubic feet per second capacities and unreinforced concrete structures for Courtland canal's second section near Mankato, Kans. About 69,000 cubic yards of excavation are involved.
Missouri River Basin, Nebr.	Installation of 4-inch pump with intake and discharge lines for removal of sand deposits at entrance to intake channel of Franklin South Side pumping plant near Franklin, Nehr.
do	Construction of 2 24-inch diameter drain wells and 1 12-inch diameter abutment drain at Enders dam on the Frenchman Creek near Enders, Nehr.
Missouri River Basin, N. Dak.	This contract combines Buchanan and Edmunds road work. Buchanan work includes raising 0.5 mile of road and surfacing with gravel and constructing a bridge over the James River in the Jamestown reservoir area 10 miles north of Jamestown, N. Dak. About 130,000 cubic yards of excavation will be required. Raising about 1 mile of Edmunds road, surfacing with gravel and raising present steel truss bridge over the James River in Jamestown reservoir area about 23 miles north of Jamestown will require 15 tons of reinforcing steel, 45,000 cubic yards of excavation for road fill, 2,700 feet of wood piles, and 15 M b. m. structural bridge timber.
Riverton, Wyo.	Construction of open and closed drains in North Portal and North Pavillion areas near Riverton, Wyo.
Vermejo, N. Mex.	Rehabilitation of Vermejo diversion dam, 11 miles of 600 cubic feet per second Vermejo canal and 24 miles of 300 cubic feet per second Eagle Tail canal, 8 miles northwest of Maxwell, N. Mex. is to include: Revising the diversion dam headworks structure by lowering the gate sills, blocking the 9 existing openings, enlarging the outlet structure to 450 cubic feet per second capacity, and installing 9 new slide gates. The existing sluice gates will be replaced by 3 new slide gates with some earth dike and bank riprap protection. Canal and channel excavation, new sluiceway, siphons, wasteway drops and drainage inlet structures for Vermejo canal. Canal excavation, 1,400 feet of Kellner-type jetties, 1,800 cubic yards of dumped riprap on river bank, gate, controlled sluiceways, checks, siphons, and drop structures for Eagle Tail Canal.

United States Department of the Interior, Douglas McKoy, Secretary

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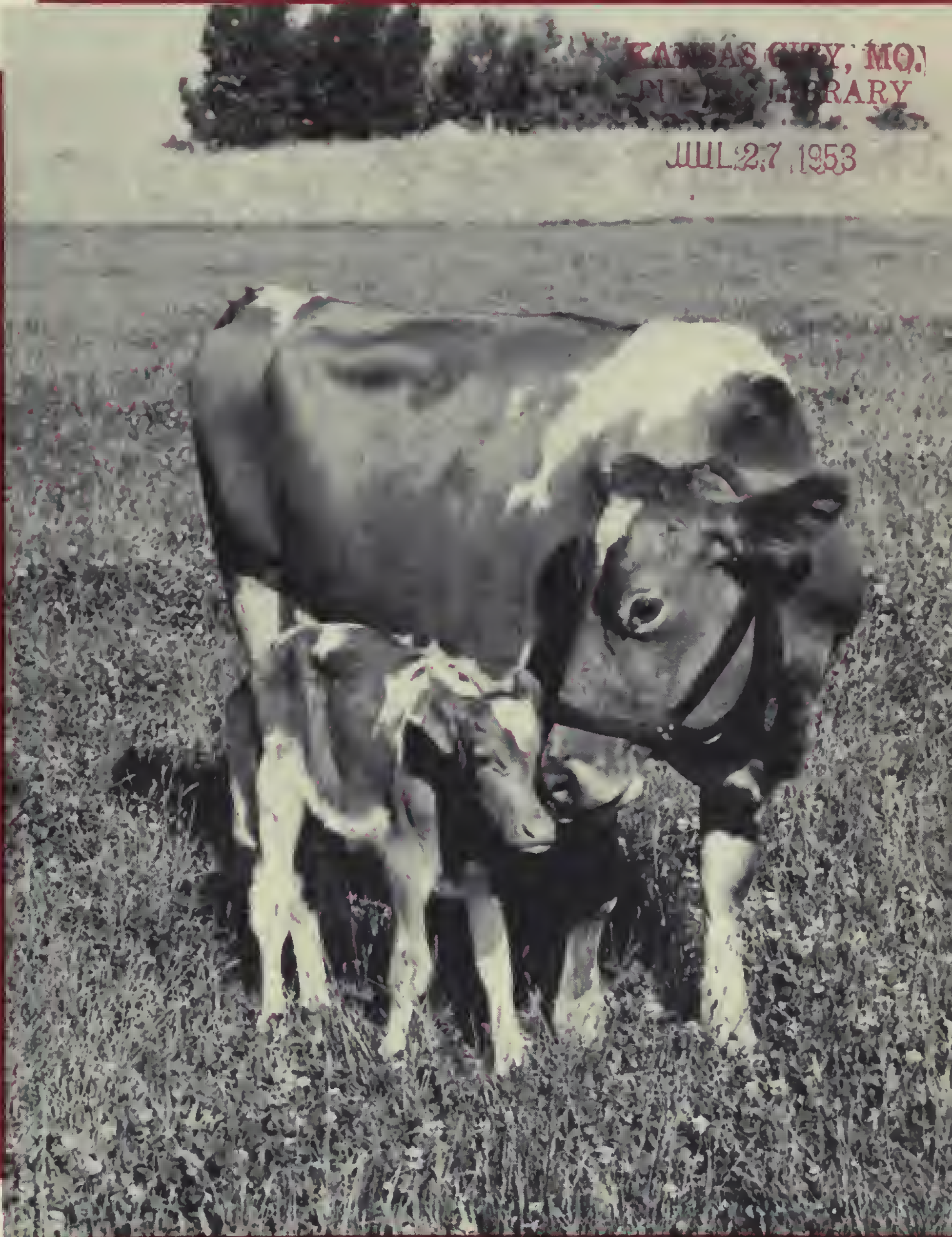


JULY 1953

OFFICIAL PUBLICATION OF THE BUREAU OF RECLAMATION

July 1953

Volume 39, No. 7

The Reclamation ERA

Special Notice To All Subscribers

Beginning this month the Reclamation Era will become a quarterly publication. Subscription rates will be 50 cents per year, 15 cents additional required for foreign mailing. Separate copies may be purchased for 15 cents each. Under the new policy all future subscriptions should be sent direct to the Superintendent of Documents, Government Printing Office, Washington 25, D.C. Subscriptions now in force will be extended for a maximum period of 2 years. If, at the expiration of that time, subscribers have not received all the copies due them under the previous subscription rate a refund will be made by the Superintendent of Documents.

DESIGN AND ILLUSTRATIONS by Graphics Section Bureau of Reclamation, Washington, D. C.

J. J. McCarthy, Acting Editor

Issued quarterly by the Bureau of Reclamation, United States Department of the Interior, Washington 25, D. C. The printing of this publication was approved by the Director of the Bureau of the Budget, May 5, 1953.

Water is Wealth

In this issue . . .

DAIRY PRODUCTS PRODUCED ON IRRIGATED PASTURES are the backbone of the irrigation economy in the Boise Valley of Idaho. *Photograph, courtesy University of Idaho Extension Service.*

PASTURE IS A CROP

by HOWARD B. ROYLANCE, Agronomist, University of Idaho Extension Service

Pasture is a crop and should be considered as such. The right kind of pasture produces more and cheaper feed for livestock than any other crop a farmer can raise. All livestock does better on good pasture. A poor pasture may actually be a liability. Not just any chunk of ground with green stuff on it can be called a good pasture. Too often it is a pasture in name only. Many times it would be better if the field were plowed up and put to some other use. In times of declining livestock prices good pasture is more important than ever. A farmer must get all he can from his acres.

Pasture as a crop is important enough that it deserves to be on good soil. However, the drawbacks of poor soil can be minimized by proper management of both the land and the livestock. The type of soil and its location should be taken into consideration in starting pastures. The grazing fields should usually be handy to barns and corrals.

Generally a mixture of grasses and at least one legume is desirable for an irrigated pasture in Idaho. Forage from such mixtures will be high in proteins and minerals and provide maximum yields during the season. As the growth of grasses slows down during the heat of the summer, the legumes thrive. The pasture mixture recommended by the University of Idaho for general use on irrigated land is 6 pounds of Manchar smooth bromegrass, 4 pounds of orchard grass, 4 pounds of alta fescue, and 2 pounds of ladino clover. That is the amount of seed for 1 acre. In places where irrigation water is not plentiful, a mixture of 6 pounds of Manchar smooth brome,

PASTORAL SCENE near Overton, Nev., exemplifies benefits of irrigated lands to desert areas.

6 pounds of crested wheatgrass and 2 pounds of Ranger alfalfa is recommended.

The first essentials for a good seedbed are firmness and availability of moisture near the surface. Spring tillage operations usually include plowing, disking, harrowing, floating, and packing. Early spring working is desirable to compact the seedbed, save moisture, and eliminate weeds before seeding.

Early spring is generally more favorable for establishing pastures than any other time. Seeding should be delayed, however, until danger of severe frost is over as clover seedlings are easily killed by cold. Late fall seedings are not usually successful because they are too readily injured by winter.

Drilling of seed is preferable to broadcasting, if steps are taken to make sure the seed is placed at a uniform depth not greater than 1 inch. Half an inch is better. A firm seedbed helps to control depth of seeding. When the mixture is to be seeded with a drill, the grass seeds should be seeded through the grain compartment of the drill. The clover should be seeded through the legume attachment. The use of rice hulls as an aid to seeding shows considerable promise. Enough seed for an acre is thoroughly mixed with a bushel of rice hulls and seeded through the grain box with the drill set at the rate of 75 pounds of wheat. This gives an even distribution and prevents bridging in the drill box. If a satisfactory drill is not available, the broadcast method may be used. In that case the seedbed need not be as firm, but it should be harrowed immediately after seeding to bring the seed in contact with moisture. Rolling helps to pack the seedbed and keeps moisture near the surface.

So the young plants will have every chance to firmly establish themselves, special attention must be given to irrigation. Apply water frequently enough to prevent surface drying of the soil. Pastures should not be grazed early the first summer. If conditions are favorable, there may be enough growth to permit pasturing toward the end of the season. If this is done, livestock should be removed early so the plants have an opportunity to make recovery before frost.

Even on established pastures grazing too early in the spring should be avoided. The carrying capacities of pastures will be greatly increased by withholding livestock until grasses have made a growth of at least 6 inches. Too much grazing is the common cause of low carrying capacity of pastures. Overgrazing weakens the plants and causes them to be shallow rooted and low producers.

Pastures require an abundance of water. Systematic irrigation is necessary not only in establishing a seeding, but throughout the life of the pasture. Maximum production is obtained only when plants do not suffer from lack of water at any time during the growing season. Grazing while watering the pasture is damaging to the plants and should not be done.

The best way to fertilize pastures is to top dress with barnyard manure each fall. This practice, combined with proper irrigation, may result in increased pasture yields as high as 50 percent. Fall or winter applications of manure stimulate growth in early spring and through most of the season. Commercial fertilizers can also be used profitably. Most pastures will benefit from an application of 40 pounds or more of actual nitrogen per acre. Addition of phosphorus is desirable for growth of legumes.

Clumps of tall grass often surround droppings of cattle. They are not eaten and, therefore, reduce the carrying capacity. This loss can be avoided by using a spike-tooth harrow frequently to break up and scatter manure. Clipping of old bunchy growth not used by the stock will stimulate new, palatable forage.

Rotation grazing will aid in survival of pastures. It is desirable to divide pastures into three or more units. One unit may be grazed while the others are renewing their growth. This kind of management will provide better pastures throughout the season. This is desirable for high production of all types of livestock.

The use of a number of pastures rather than one, as in continuous grazing, calls for more fencing and more watering places. However, the increased returns more than justify the increased costs. # # #

ATTENTION ALL ERA READERS

This is a reminder that beginning with this issue the Reclamation Era will be issued quarterly.

The next issue will be published in October. Please see inside front cover for details.

MOWING PASTURES (left) helps control weeds, keep an even sward, and control bloat. For this purpose mow about one-quarter of each pasture unit before turning in stock. Below, Drilling Ladino clover.

TIME TO IRRIGATE

Simple Soil Test Tells When To Irrigate

by C. H. DIEBOLD

1. Take typical handful of soil from a depth of between 6 and 12 inches. 2. Squeeze the ball of soil firmly three or four times. 3. If the soil is too dry to form a ball, it contains less than one-quarter as much readily available moisture as it would have when at field capacity. 4. Soil moist enough to form a ball contain at least one-quarter the amount of readily available moistur it would have at field capacity. *All photos in this story by Joh Land, SCS regional photographer.*

Editor's Note: Mr. Diebold is survey supervisor for the U. S. Soil Conservation Service, Albuquerque, N. Mex. The article is reprinted from "What's New in Crops and Soils" published by the American Society of Agronomy.

When do you need to irrigate? To what level should the "readily available" moisture in the crop root zone drop before you put on water?

For most row crops, you can delay irrigation for several days if the "readily available" moisture is more than one-half the total amount that can be held in the soil at a depth of 6 to 12 inches.

In contrasts, growth has slowed up and you have missed the best time to irrigate when the level of readily available moisture is lower than one-fourth in the 6- to 12-inch layer.

The best way to maintain rapid growth is to irrigate when the level of readily available moisture in the 6- to 12-inch layer is between one-fourth and one-half.

What is readily available moisture? It is the volume of water occurring between the moisture level, field capacity, and the level at which plant with mature root systems begin to show drough symptoms. It is the moisture that a plant ca obtain easily from the soil while maintainin rapid growth.

We consider that a soil is at field capacity days after it has been well-soaked by irrigatio or by heavy rain. We say it is at the other limi when plants with well developed root system begin to show signs of wilting. Readily avail able moisture, then, is the amount of water that soil can deliver easily to plants between the two points.

We have calculated the readily available mois ture values for the surface foot of various soi in the Southwest.

These values are based on irrigation trials, an they cover the common ranges of soil textu They represent the average depth of water tha can be held in readily available form.

2.1 inches per foot of soil for medium to fin textured soils.

- 1.2 inches per foot for sandy loams containing more than 70 percent sand and for loamy sands up to 85 percent sand.
- 1.0 inch per foot for loamy sands containing 85- to 95-percent sand.
- 0.7 inch per foot for sands—more than 95 percent sand.

As expected, sandy soils hold smaller amounts of readily available moisture than heavier soils. But, to our surprise, there was little difference between fine sandy loams (less than 70 percent sand), loams, silt loams, clay loams and clays.

Now, with this information, if you learn to estimate the percentage of readily available moisture present in the soil, you can then estimate the inches of water to be applied to bring the root zone to field capacity.

You can also better determine when the moisture content is suitable for tillage. Just because the soil is not sticky, don't think that you can operate without creating a tillage pan.

Preliminary studies indicate that tillage pans may be created by most farm implements, when more than one-half of the readily available moisture is present in the soil. Of course, the one-way disk is especially bad in creating tillage pans, but don't overlook the other tillage implements.

Although this article is directed largely toward irrigation farming, the writer has found that estimating the percentage of readily available moisture present is helpful on dry farm lands also.

Here, the amount of readily available moisture at the time of planting winter wheat may be the difference between success and failure. You can also evaluate different tillage and management practices as they affect storage of moisture in the soil.

The author has tried several methods of estimating readily available moisture over a period of years in New Mexico, Colorado, Utah, and Arizona. Of these, the "ball test" for estimating readily available moisture in medium to fine-textured soils appears to be the most practical.

A spade is perhaps the most satisfactory tool for examining the surface foot of soil. For deeper depths, a soil tube or an auger is helpful in taking samples quickly.

For the steps to be followed in estimating readily available moisture, please refer to the photos accompanying this article.

The same clues apply to the sandy soils except that the balls of soil are usually fragile for the entire range from one-fourth readily available moisture up to field capacity.

5. Toss moist ball about a foot into the air. 6. If the ball still remains intact after it has been tossed five times, it is durable. It will contain more than one-half readily available moisture. You won't need to irrigate at this level. 7. If the ball breaks with five tosses or less, it is fragile, and contains one-quarter to one-half readily available moisture. This is the best time to irrigate. 8. Ball is durable when moisture is at level of three-quarters of field capacity. 9. If thickness of one-fiftieth of an inch, or more, sticks to your thumb after soil is squeezed firmly, readily available moisture is between three-quarters and 100 percent of field capacity.

If you follow the procedures, you should be able to estimate within one inch the depth of water that you need to apply to fill the root zone. The ball test is a sound, proven guide for the farmer who wants to apply water efficiently. ###

SHAPING NEW DITCH at about 100 feet per hour, left. Above, removing moss and silt at rate of 1 mile per day per machine. *All photos by the author.*

SALT RIVER'S PROBLEMS SIMPLIFIED

by D. W. NICHOLS, Chief Draftsman
Salt River Valley Water Users' Association

Editor's Note:

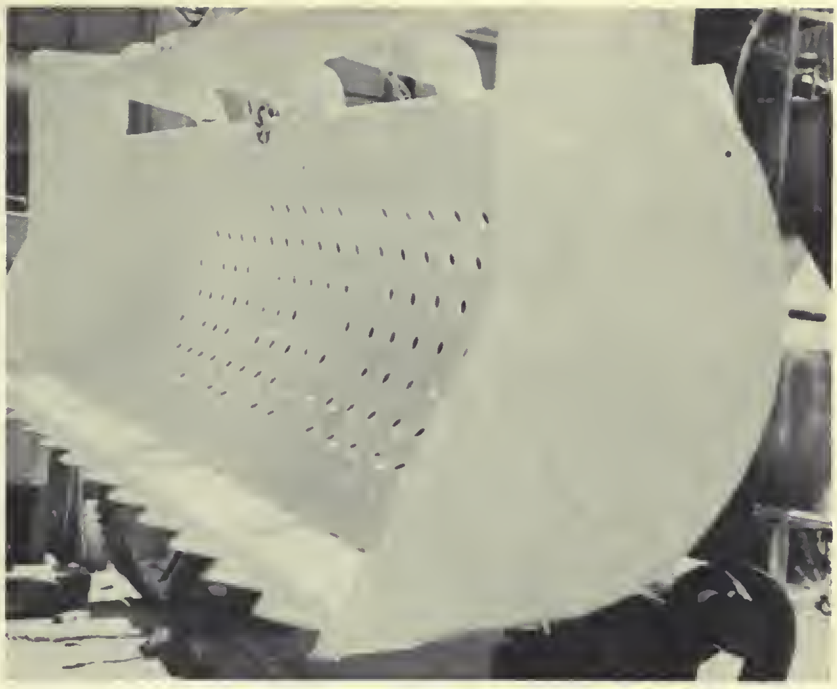
The equipment described in this article has been particularly useful in the Salt River Valley because of a large metropolitan area and rapid urban development within the project boundaries. As the author points out, the hydraulically controlled boom type excavating and grading machine is well suited to such conditions because of its movability.

Ditch cleaning, maintenance, and construction have been made easier for the Salt River Valley Water Users' Association by the addition of five hydraulically controlled boom type excavating and grading machines to their fleet of heavy equipment. These machines have proven themselves to be more than adequate to perform economically such jobs as ditch cleaning, ditch shaping, canal demossing, excavating, truck loading, setting tile, and many other smaller jobs. They are especially adapted to trimming and grading canal banks in preparation for gunite lining. They work with equal ease from either the canal bank or the canal bottom, and grade within tolerances that normally would be expected only from hand labor.

Two new types of buckets were made in our shops for use on the machines, and more special purpose tools are in the making. One bucket, used for demossing canals and laterals, is shaped somewhat similar to the 60-inch ditch cleaning bucket supplied by the manufacturer, but is 72 inches wide. It uses a hard-faced serrated cutting edge to cut the moss on the canal bottom, and the whole bucket is perforated to facilitate drainage as it is normally used under water.

A large amount of moss and some silt is removed with each pass of the bucket, resulting in about 1 mile of ditch demossed per day per machine. This work is done in conjunction with our regular method of demossing, which consists of teams or tractors dragging chains or a disk harrow through the canals and laterals. Temporary pipe grates are placed in the ditch downstream from the demossing crew (usually at a check structure or a culvert), to retain the free floating moss. As the moss gathers on the grates, it is removed with hand rakes, and deposited on the ditch bank for removal. Where the use of the machine is more applicable for demossing and cleaning, the costs average approximately $68 per mile, which is about one-half the cost of demossing with chains or disk harrows.

Another advantage of the grading machine is on ditches where, due to physical characteristics, namely, lack of maintenance roadway right-of-way and accessibility for tractors or teams, hand



DEMOSSING BUCKET uses hard-faced serrated cutting edge to cut moss on canal bottom, and the whole bucket is perforated to facilitate drainage as it is normally used under water.

demossing was necessary after drying the particular ditch. The use of the machine in these ditches results in considerable saving of time and reduction of water loss, since this method does not require a dry up.

A further advantage of the machine in demossing is the fact that a cleaning operation is incorporated along with the demossing, thereby eliminating an additional pass through the ditch with the hand crews at a later date.

Various machines and devices have been purchased and built in our shop to assist in the cleaning and demossing of ditches, but have not met with the success that has been obtained with the hydraulically controlled bucket operation.

Another bucket, used for shaping ditches preparatory to gunite lining, has proved to be as successful as the demossing bucket. Like the cleaning bucket, it varies in design from the manufactured attachment. By turning the cutting edges slightly outward and downward, closer control and ease of operation was accomplished. Several of these buckets were built with varying bottom widths and with wings extending upward on a three-quarter to 1 slope to conform to the desired ditch section. These buckets have a capacity of about ⅓ cubic yard and are equipped to utilize the standard hydraulic bucket hook up.

In operation the machine travels over the center line of the new ditch, digging and shaping to the desired grade. There remains very little hand work to be done after the shaping operation, which proceeds at about 100 feet per hour.

In the event the old ditch is to be lined, it is first backfilled, compacted, and reexcavated. There are several advantages to this procedure. First, the excavating machine can travel over the center line of the ditch making its cut with a series of passes, always parallel to the center line of the ditch. This results in a very straight trench free of the variations in alignment found in ditches excavated by other methods.

Usually the required ditch section is somewhat smaller than the existing ditch to be lined. Considerable savings in space and materials can be made by backfilling. Another advantage is a uniform ditch section. Since the buckets were made to conform to the desired ditch section, the bottom width, top width, or side slopes, cannot vary. The resulting ditch is straight and uniform, and must be seen to be fully appreciated.

The economy of this operation is outstanding. Comparing to the previous method of excavating with a dragline and finishing by hand, the hydraulically controlled machine does the job *better* and *faster*, and without hand finishing at about one-fifth the cost. Excavating, shaping, and finishing averages about 22 cents per cubic yard, or about 11 cents per linear foot of ditch.

Although the machine is unexcelled at preparing

(Please turn to page 137)

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"FARMERS' TOWN HALL"

The farmer in the fields of the Columbia Basin project moved into the "town hall" for an afternoon this winter, and the consensus of both the Bureau of Reclamation and the farmers is that the move was "excellent."

The purpose of the meetings was to let the farmers bring up the questions about irrigation in this 1,029,000-acre project that started large-scale development in 1952.

Meetings were called on different days by each of the three Columbia Basin project irrigation districts—the Quincy-Columbia Basin, East Columbia Basin, and South Columbia Basin.

The presidents of each of the districts presided at their respective meetings—Don Damon for the East District, Jake Weber for the Quincy District, and Loen L. Bailie for the South District.

Bureau of Reclamation officials on the project were invited to "sit in" at all meetings to answer questions and to explain the procedures followed in operating and maintaining this project.

In the words of E. H. Neal, supervisor of O. & M. for the Bureau of Reclamation, the meetings "helped a lot."

"The small sore spots that come up in the course of any season don't get a chance to become boils," he points out.

Representatives of the Land Development Branch of the Project Development Division, which operates the five development farms on the project, attended all meetings to answer questions on types of soils, crops, and fertilizers tested by State and Federal agencies.

The Land Division sent representatives to answer questions about leases and rights-of-way.

Among the questions discussed were development period operation and maintenance charges, land classification, water allotments and waste water.

It was explained that the cost of water is set to charge higher amounts for excessive use to protect the land from overirrigation.

Some of the older line irrigation farmers answered the very questions raised by some of their neighbors—by telling them how much water it should take to irrigate a given field.

"We exchanged information at the grass roots level," Neal reports, "and that means everything in a project as big as ours. This year we were dealing with a thousand farmers, but before development is complete, we'll do business with 14,000. If we can keep this grass roots approach, we'll go a long ways toward making a success of relations between the settlers and the Bureau on the project."

In this connection, Neal hopes that meetings can become annual get-togethers at which the settlers express firsthand what's on their mind and get the explanations directly at an open session sponsored by their irrigation districts. ###

YOUR MAGAZINE

Are there particular types of articles which you would like to see in the ERA that we have not printed to date? If so, please let us know, and we shall do our best to comply with your wishes.

(Continued from page 135)

open ditches, it is by no means idle when a ditch is to be replaced by concrete pipe. By traveling down the center line of the pipeline location, it can trench with the same ease that makes it so adaptable to ditching. Speed and economy are not sacrificed by using the light, highly mobile machine, as it has proved itself to be a fast, economical trencher. In fact, it can boast of many advantages. Working in tight places, in trees or around power poles and other obstructions is a specialty of the machine. It uses a telescoping boom, and requires no elbow room or overhead boom clearance. Under normal operating conditions, no concern must be given overhead obstructions as low as 12 feet. This eliminates the danger of contacting power lines.

Work is always done at the end of the boom, eliminating the danger of swinging buckets or loads. By the addition of a close-coupled pipe hook, the machine becomes an excellent pipe setter. It can spot concrete pipe with speed and accuracy without sacrificing safety and can backfill the trench over the newly laid tile using standard attachment supplied by the manufacturer.

The machine has its advantages in truck loading. Close control on both cut and dumping can be maintained, and its loading cycle is quite rapid. It can work in the pit or from the top, or from on top with the truck in the pit.

In general, much can be said for the machine. It is fast in operation and on the road (55 miles per hour). It is as maneuverable as any 10-wheel, 193-inch wheelbase, tandem drive truck. It requires only 10-foot clearance, and weighs only 32,450 pounds. It has ample power (65-horsepower machine—106-horsepower truck). Its lifting capacities are 5,000 pounds with boom retracted, and 1,600 pounds with boom extended.

We are sure we haven't discovered the full extent of the machine's usefulness, for we are planning new methods and new tools and attachments to increase the versatility of this already versatile machine. ###

Australian Hydroelectric Chief Grateful for Reclamation Engineers' Help

Snowy Mountains Hydroelectric Authority Commissioner William Hudson, addressing the Australian electrical industry convention at Canberra early in May, said that the Snowy Mountains project—the most outstanding engineering project in Australian history—would be to a great extent a monument to the personnel of the Reclamation Bureau.

Mr. Hudson said it would be impossible to assess the value of the contribution made to the project by the Bureau of Reclamation, which he described as "one of the outstanding examples of farsightedness in the world's history." The Bureau has probed the whole world for information on all aspects of water conservation, hydroelectricity generation and flood control, and amplified this with knowledge gained in its own work over many years.

In addition, Mr. Hudson said, Reclamation was permitting engineers from the Australian project to work side by side with its engineers on great American projects, thus giving them experience they could gain in no other way. It was his aim, he added, that every senior engineer of the Snowy Mountains project should have the benefit of working with the Bureau of Reclamation engineers.

The Snowy Mountains project of southeastern Australia is now in a major construction stage. In a review of the project, Barbara Ward, former assistant editor of the London Economist, said: "When America finished the Tennessee Valley Authority it caught the imagination of people everywhere and they came from all over the world to see it.

CALIFORNIA PROJECTS ORGANIZATION

Secretary of the Interior Douglas McKay recently announced that the Bureau of Reclamation's Region 2 in California was to be discontinued July 1.

He announced a California Projects organization with headquarters at Sacramento to administer the Central Valley, Cachuma, Solano and Orland projects in northern California and the Klamath project, California-Oregon. Clyde H. Spencer, a Reclamation career employee of 34 years' experience, was appointed supervising engineer. Spencer's most recent job was construction engineer, Hungry Horse Dam, Mont.

Secretary McKay stated "that the work of the Bureau of Reclamation in California will go forward without interruption and in accordance with appropriations now being considered by Congress." Richard L. Boke, resigned as Director of Region 2, effective June 30.

NEW INDUSTRY IN THE COLUMBIA BASIN

LARGE-SCALE IRRIGATION in the Columbia Basin project will result in many new large industries in the project area. The first of these is the sugar-beet industry. The above photo, typical of land in the Moses Lake area of the Columbia Basin project, part of 6,000 acres were being planted to sugar beets this spring. This is almost double the 3,288 acres planted to the crop in 1952. This year's harvest will be refined in a new $9,000,000 sugar plant (photo below) now under construction.

The average yield last year for sugar beets in Columbia Basin was approximately 22 tons per acre, compared to the 14 tons national average. Both photos were taken by F. B. Pomeroy, region one, headquarters Ephrata, Wash.

NORTH FACE OF MAJESTIC SCOTTS BLUFF (background) AND NORTH PLATTE RIVER IN SCOTTS BLUFF COUNTY, NEBRASKA.

THE DESERT TAMED

by

Antoinette H. Sands

Author's Note: The following article, covering a phase of the development of early irrigation in the North Platte Valley, is affectionately dedicated to my father, the late Frank M. Sands of Gering, Nebr., and Denver, Colo., who is the "engineer" mentioned in the sketch. He was often referred to by his friends and associates of the early days as the "Desert Tamer." Former Reclamation Commissioner Harry W. Bashore, Arthur B. Reeves, and the late Andrew Weiss were the engineers in charge of the construction of the Gering-Fort Laramie Canal as a part of the Bureau of Reclamation's North Platte Project. In a recent conversation with Mr. Reeves, he told me that he well remembers when Mr. Sands spent several days at their camp, consulting with them on the "puddling process."

LIKE A DANCING DERVISH the west wind came howling through Mitchell Gap, swept up into dust clouds the loosened earth of the prairie, pulverized by the restless feet of grazing herds, and in a wild fury descended upon the beautiful Gering Valley. Heedless of the curses of the early settlers and the plaints of their long-suffering wives, these two, the dust and the wind, wreaked their havoc. And the big, black cloud that had hung in the western sky for hours, giving promise of rain, ended in just another 3-day blow.

The broad North Platte river flowed in all its grandeur along the north side of Gering Valley. Picturesque bluffs, majestically headed by Scotts Bluff jutting up to the river with badlands at its foot, encircled it west and south, tapering into a low lying ridge paralleling the river. From symmetrically formed Dome Rock, standing out from its fellows like a sentinel, looking north across the river and to the east, the view was unbroken until the blue, western sky touched the curve of the earth.

Encouraged by the promise that the spring rains gave, the early settlers enthusiastically planted. But year after year their hopes were blighted when the green of their crops became parched and brown by early July and field after

1. Gering headgate, early days. 2. Gering ditch around Gering valley. 3. Badlands, showing present Gering ditch, still in operation. 4. One of Frank M. Sands' farms. 5. Beets taken from his farm after irrigation. 6. Irrigating beets. *All photos courtesy of Author.*

field went down under the withering sun and the devastating dust storms.

After several seasons, heartsick and beaten, many deserted this capricious land and returned to their former homes back East. But a handful struggled on.

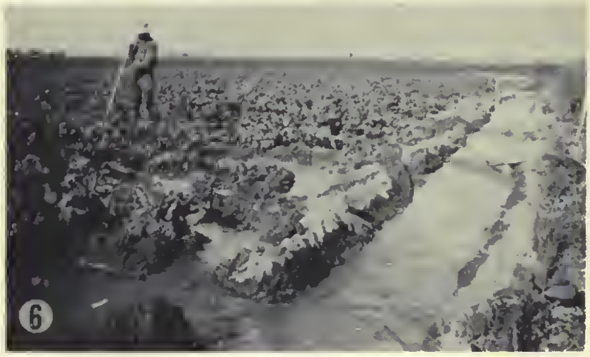
To the west, in Mitchell Valley, the inhabitants had developed a very creditable irrigating system. But for Gering Valley, Scotts Bluff with the badlands at its foot, formed a beautiful but defiant barrier to so simple a ditch-making scheme. To a visionary few it could be seen that by enlarging the Mitchell ditch, bringing the water from as high as its headgate, then across the 6-mile extent of badlands and into the valley, irrigation could be accomplished.

But those challenging badlands! There must be cuts, there must be fills, and in those days there was no huge, motor-driven machinery—the puny strength of men and horses, the only power.

Headed by one of this number who had a knowledge of engineering, the undertaking was physically entered into the summer of 1898. A nucleus had high hopes, many were skeptical, others openly antagonistic, maintaining that it was a "cow country" and that nothing else could be made of it.

That fall the Swanson fill across the first small canyon was completed and the work was being pushed on into the rough region beyond. The formation of these badlands is a peculiar shale known as "hardpan" and when blasted and exposed to the elements crumbles into a flourlike dust. The savage fall and winter winds turned the ditch camps into choking infernos, temporarily blinding horses and drivers. As the load of the two-horse slip or the four-horse buck-scraper was dumped over the edge into the yawning chasm below, it seemed that half of it was caught up by the demon winds and only a pitiful spoonful reached the bottom.

That winter was the severest the early settlers



had ever known. Many mornings the mercury stood at 40° below zero, congealing the spirit as well as piercing to the very marrow of the bone. Raging blizzards were borne in upon the wings of the wind, overcoming all but the hardiest. Still the work was pushed forward. By spring the first big fill, the Vickery, was finished. The water was diverted over the Swanson wasteway while the last scraper load was dumped to complete those high banks. A small head of water was then turned down the new ditch. It crept along, soaking into the newly cut earth, over the minor fills. Slowly it went as though feeling its way onto the white dust of the big fill. For 3 days this small amount of water was allowed to seep over the new work. The anxious watchers did not leave it day or night.

More water was turned down and another week's test given. The tension began to lessen. The keen concern wore off. The fill was holding. Farther on the work upon the next big fill was being started. But the Vickery fill must carry more water than this. The check was opened wider. The sides of the ditch were fully soaked, the new head moved with a more positive motion, faster. It was a volume of water. It reached the fill, rushed across, but the additional heft was too great, the pressure too severe. The treacherous hardpan melted. The taxing winter's effort was ruthlessly washed away.

Undaunted, immediately a bigger crew of men and horses were put to work to rebuild the fill. It was completed by late summer and again that painstaking test—the gradually increasing amount of water, the lengthening period of soaking. With a good volume it held. When an approach to the maximum was turned in, it held for a short time. But again the treacherous hardpan crumbled beneath the weight and wash.

The high hopes of the early settlers were turned

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RIO GRANDE'S WEED CONTROL PROGRAM

by F. D. Postle, Farmer Irrigatian Superintendent, Ria Grande Praject Ysleta Branch, New Mexica-Texas (Naw af Oklahama City Planning Office), Regian 5 (Headquarters at Amarilla, Tex.)

The Rio Grande Irrigation Project in New Mexico and Texas has long recognized the need for effectively controlling weeds and woody plants on project rights-of-way and in ditch channels. However, because of economic conditions and emergency restrictions for the last 20 years, which strictly limited funds, equipment, materials and manpower, an effective weed-control program was not initiated until 1948.

Various methods to control weeds, i. e., mowing, burning, grazing, spraying with fortified oils, hormone-type herbicides and hydrocarbons, plus soil sterilization to attack the more aggressive types of noxious weeds, were utilized on the project.

Parrot Feather (Myriophyllum Proserpinacoides) had infested three of the Ysleta Branch's larger drain channels to such an extent that the water surface was entirely hidden from view at many points. The choking effects of the plants raised the water surface elevation as much as 3 feet, and this condition jeopardized the productivity of adjoining lands.

Cattails (Typha latifolia) first infested the entire open-drain system. Later they began to invade the canals and laterals at an alarming rate. The cattails also created large berms. By midsummer 1948, the capacity of the smaller laterals was reduced as much as 50 percent and the entire irrigation schedule was endangered.

Willows were growing along 157 miles of ditches in stands varying from sparse to heavy. The willows interfered with maintenance work and the transpiration resulted in heavy water losses. Practically every mile of right-of-way was infested with Johnson grass.

Equipment selected for the weed war included two farm tractors with mower attachments. One tractor was a Ford-Ferguson, with a special pitman that was made in the Branch machine shop. The sickle was extended so that it could cut down the inside ditch slope while the wheels remained far up on the ditchbank. The other tractor was an Oliver-Davco, with a hydraulically operated sickle that would cut extremely heavy weeds and woody plants.

For spraying and burning, a model 4110 MT bean sprayer was chosen. The 200-gallon tank motor, pump and agitator were mounted on a 1-ton truck. The boom of ¾-inch steel tubing, supported by a truss, is constructed in sections, which

PARROT FEATHER covers drain from side to side in many places on Rio Grande project. Cattails, Salt Cedar, and willows can also be seen in this photo, taken by Fred S. Finch, Region 5.

allows a reach of 14 to 25 feet from the edge of the truck bed. A spray bar 90 inches long with 6 disk type Myers Monarch nozzles and $\frac{3}{16}$-inch openings, spaced on 18-inch centers, is attached at the end of the boom so that it can be set at any angle desired. The boom is mounted on a standard with a universal joint which fits into a socket on either side of the truck bed. Replacement of the Monarch nozzles by Delco No. 12 tips converts this sprayer to a burner. For spraying only, an 800-gallon tank sprayer with motor-driven compressor and a horizontal paddle-type agitator mounted on a 2-ton flat-bed truck was purchased. An E and E collapsible 3-sectional 32-foot hydraulic boom is mounted on the right side of the truck near the cab. The boom is adjustable so that the 3 sections can be raised or lowered to fit ditch conditions. Also, each section of the boom is individually controlled from the sprayer allowing spraying from any or all sections at the operator's convenience. In addition, the operator can rotate the boom horizontally, either backward or forward for convenience in passing objects. The boom folds into a triangle and rests upright against the side of the truck for transportation. Most any type of nozzle can be used and spaced as desired. The Branch in addition has two 50-gallon capacity oil burners equipped with pumps and regulators which can be trailed or mounted in a pickup and used for spot spraying or burning. These are particularly valuable in treating isolated clumps of Parrot Feather.

After many check tests the following combination of methods has been adopted as standard in control of Parrot Feather in the Ysleta Branch drains: With the growth at its peak and water surface elevation at its highest (July through September), the drain is cleaned by a dragline. In early December, returning growth is sprayed thoroughly with either 27 burner oil or 32 Diesel oil fortified with 1 quart of 50-percent pentachlorophenol per each 100 gallons. A patrol is made in 45 to 60 days and from that time patrols are made at 90-day intervals, using the same spray formula. The average cost of Parrot Feather control, following cleaning, during 1950 was $17.44 per mile over 22.34 miles, for 1951 was $17.10 per mile over 44.39 miles, and for spot spraying required during 1952 was $5.11 per mile. The cost of draglining prior to use of oil spray methods was over $200 per mile. In no treated drain has return growth amounted to more than a minor fraction of 1 percent.

In control of bank weeds all brush is carefully cleaned from the inside slopes and top of banks by mowing, slashing or blading during the winter maintenance season and good operating roads are prepared. When new growth or shoots are fairly well started in the spring, and before new crops are through the ground, a spray consisting of:

Sodium salts of 2,4-D acid equivalent	1½ pounds.
Triton X–100	1 pint.
Diesel fuel oil	5 gallons.
Water	95 gallons.

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BUTANE-PROPANE burner clearing grass and weeds from lateral banks (at right). Below: Spraying weeds with fortified oil on Franklin Canal, Rio Grande project. ***Both photos by J. G. Koogler, Region 5.***

Fertilizer Facts

ARLEY DELP on his Yakima Roza farm found spots wilting in his alfalfa field. Upon his request Bureau of Reclamation representatives made investigation and found land needed phosphate. *Photo by Wayne Fuller, Region 1.*

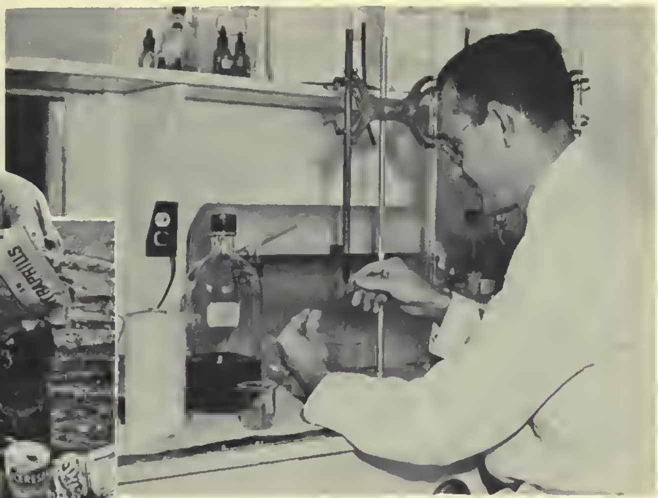
by J. V. BRIGGS,
Owyhee County Agent,
Owyhee County, Idaho

It is surprising to realize how many misconceptions there are about fertilizers. Many questions are being asked by farmers in relation to the soil-testing work done by the county agent. Ninety-eight soil samples were analyzed during last January and February. Each sample is tested to determine the amount and type of salts and available phosphate present. The test also determines the organic matter content which indicates the potential nitrogen level.

Most farmers want to know what fertilizers will be needed for maximum crop yields. The soil test is a reliable measure before crops are grown.

Starting with first things first, it is important to take the soil sample properly. Instructions are simple: using an irrigation shovel, spade out a V-notch in several places in each sample area. Slice off 1 inch of soil from one side of the V-notch and cut a strip 1 inch wide in the center of the soil slice. This will leave a cube of dirt 1 by 1 by 6 or 7 inches long, depending upon the size of your shovel. Place this cube in a container and secure as many more as will give a true average, composite sample of the field. Place these samples in a clean sack or on a canvas dam, and thoroughly mix. Take about 1 pound from the soil sample and place it in a labeled container, indicating the field area and deliver it to the county agent. A sketch of the farm, indicating the cropping history of each field and the general characteristics of the farm, should accompany the samples.

Barnyard manure is valuable because it is the cheapest source of plant food. A 10-ton application of barnyard manure properly handled will supply approximately 126 pounds of nitrogen, 42 pounds of phosphate, and 92 pounds of potash. Barnyard manure not only is the cheapest source of plant food nutrients, but it supplies the humus and organic matter needed to allow the water to penetrate the soil, making the plant food available to the plants. In soils lacking good tilth, the soil will run together, bake, and cut off the oxygen that is needed by the micro-organism and bacteria found in the soil. Without these soil organisms and bacteria liberating the plant food nutrients, reduced yields will result.



ROBERT JIRSA, Shoshone Heart Mountain settler (at left), is preparing to seed clover and barley on his farm. Final determinations as to land quality are often made in the "lab." Dr. C. V. Bushnell is completing such analyses.

Judging from the majority of these soil analyses, we can safely say that most farms need more fertilizers than are provided. Soils lacking certain nutrients can be supplemented by commercial fertilizers if barnyard manure is not available. Returns from the use of these fertilizers are large enough in some instances to make purchases of commercial fertilizers economically sound. When used correctly, they show a definite profit. Soils may be improved when barnyard manure and proper commercial fertilizers are used. The land will remain more productive if a good crop rotation plan is followed. Wise buying of commercial fertilizers is important if the fertilizers are to return a profit for the investment and the labor involved. Being able to supply your soil with the proper fertilizer may depend entirely upon your ability to buy commercial fertilizers wisely.

First you may need to know the symbols for some of our plant food nutrients. It pays to know all we can about anything we buy. The most common food nutrients are nitrogen, phosphorus, and potash. The symbols for these nutrients are: N for nitrogen, P_2O_5 for phosphorus and K_2O for potash. In all "straight line" formulas, these three always come in this order: N, P_2O_5, and K_2O.

The percentage composition of fertilizer is simply the percentage of each plant nutrient which that particular brand guarantees. Remember, the first figure is for the percentage of nitrogen, the second is the percentage of phosphoric acid, and the third the percentage of potash. Thus a 10–16–8 fertilizer contains 10 percent nitrogen, 16 percent phosphoric acid, and 8 percent potash. The percentages may change with the various brands of fertilizers, but the order of nutrients does not change. A "simple" fertilizer contains only one of the nutrients. They are written in straight line formulas, but there is only one figure above zero; therefore, a simple fertilizer is written 0–24–0, 20–0–0, 0–0–50.

Mixed fertilizers contain more than one plant nutrient. Examples 16–20–0, 0–20–30, and 16–0–30.

"Complete" fertilizers would have numbers above zero for the percentage of all three nutrients. Examples 10–10–5 and 4–16–4.

Your soil may need one or more of these nutrients to produce maximum yields. It may need nitrogen or phosphoric acid or it may need both. It usually costs \$10 to \$15 per ton to mix these fertilizers. It may pay to do your own buying of simple fertilizers and mix them yourself. It is not what we make, it is what we save that counts.

One precaution farmers should take in buying phosphate fertilizers is to determine the amount of available phosphate. It is the percent avail-

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MAN-MADE CAVERN is the Frenchman Hills tunnel, 16 feet in diameter, shown above. Puddle of water inside tunnel, at left, is hardly a forerunner of things to come, when enough water to irrigate 50,000 acres will pour through the structure. *All photos by Harold E. Foss, Region 1.*

FRENCHMAN HILLS' SAFETY RECORD

by HAROLD E. WERSEN, District Safety Engineer, Columbia Basin Project, Wash.

(Editor's Note: In building irrigation systems engineers may tunnel through mountains or build canals around them. In building structures for the million-acre Columbia Basin Project of central Washington, they have done both. One mountain which the engineers have tunneled through is the Frenchman Hills, located 59 miles down the 88-mile-long West Canal. Through this tunnel, water will pass which is destined to irrigate ultimately 50,000 acres, among them some of the richest land of the project. The story of dig-

ging the Frenchman Hills tunnel, recently completed, set one of the finest safety records in the history of the Bureau of Reclamation.

On any major construction job you can figure on a certain number of injuries resulting from accidents. These may range in severity from very slight to fatal. When you build a tunnel through a mountain the hazards are even greater than on other construction jobs.

These facts long had general acceptance among this class of heavy construction workers, "the muckers," and "sandhogs," and the general public. But, the Frenchman Hills tunnel on the Columbia Basin project of central Washington, which is just short of 2 miles (9,280 feet) in length, has proven the fallacy of this idea.

When the tunnel was "holed through" in the evening hours of June 27, 1952, the safety record was among the best in tunnel building history.

Prior to the start of actual work on this contract during the previous summer, General Superintendent C. C. Harris, United Concrete Pipe Corp., and Ralph Bell of Baldwin Park, Calif., with the Bureau of Reclamation's Resident Engineer Fred McCune, Chief Inspector Ralph Howtrow, and District Safety Engineer Harold E. Wersen, held three preconstruction conferences.

All procedures of tunneling, kinds of equipment, and methods to be used were planned to eliminate the accident-producing factors.

The danger ran high, from the very start, as there were approximately 400 feet of compacted sand impregnated with big rock to bore through at both the inlet and outlet portal of the projected tunnel.

It was estimated that 350 tons of steel would be needed for support of the inside walls and ceiling, but it actually took more than 700 tons of steel to support the variable types of earth that were bored through.

There are only 1,671 feet of unsupported tunnel in the 9,280-foot length. The average daily advance through this length was 32 feet per day by three shifts, 6 days a week. The maximum advance in any 1 day was 62 feet.

Frenchman Hills tunnel had four injuries outside the tunnel. The most serious was the one in which a carpenter lost a finger on a cutoff saw. The other three were minor injuries representing 1 to 3 days off the job.

There were seven lost-time injuries inside the tunnel for a total of 64 days, making a total on the operation of 385 days. The carpenter's injury accounted for 300 days (based on standard scale of time charges) of this total.

All injuries inside the tunnel were at the heading. None occurred on equipment.

In comparison with the Bacon tunnel on the Columbia Basin project, near Coulee City, the Frenchman Hills tunnel represented much greater hazards because of the nature of the material the tunnel was driven through, although the length and diameter were somewhat less.

That good safety planning paid off is no question, when comparisons are made. Bacon tunnel had 93 lost-time injuries for a total of 1,361 lost-time days. Yet this was considered a good safety record for a job of such scope and danger.

From the standpoint of a safe job, we have been informed that the Frenchman Hills tunnel job sets a record in safety for the Bureau of Reclamation. This is a major tunnel job in which the cost is not measured in lives lost. ###

BIG ENOUGH for a car to drive through, THE FINISHED PRODUCT is 9,200 feet long and approximately 14 feet in diameter (16 feet when bored).

LOW COST IRRIGATION STRUCTURES

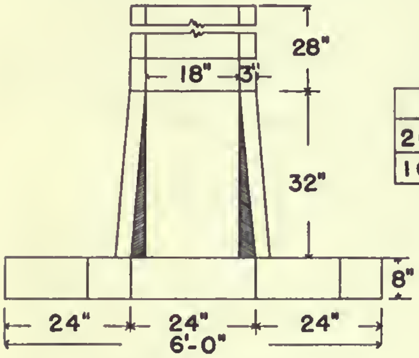
(Second of a series of three articles based on information contained in circular 122, a publication of the University of Wyoming Extension Service)

Proper irrigation structures offering efficient control of water can cut down soil erosion and water losses and help promote higher crop yields. Concrete structures, often thought to be very costly and difficult to install, are becoming more popular among irrigators, as improved techniques make them easier to install and much less expensive. Often they can pay for themselves through savings in time, soil erosion and water losses in only one season of operation.

A drop structure, which prevents water from moving too fast in the ditch bed and tearing away valuable soil, is a typical irrigation structure that can be made more efficient and durable through fairly inexpensive concrete construction.

Construction of a concrete drop is quite simple. A 6-inch concrete foundation is poured and a row of blocks put on the fresh concrete and worked into the concrete enough to secure a good bond. Succeeding rows of blocks are then mortared in until the structure reaches the desired height. The bottom of the spillway over the drop should be grouted in with concrete so that water will not run down through holes in the blocks.

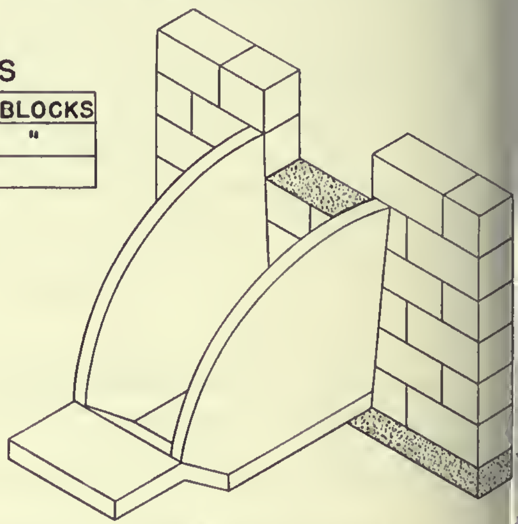
To reduce erosion losses to a minimum, it is important to install a stilling basin on the down-



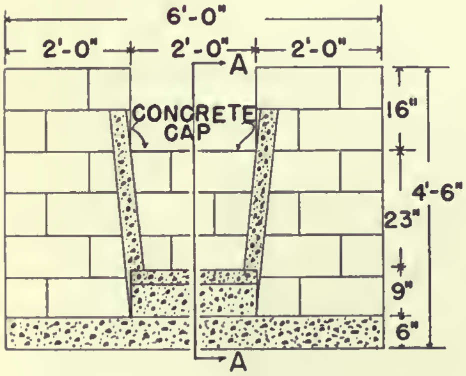
TOP VIEW

BILL OF MATERIALS

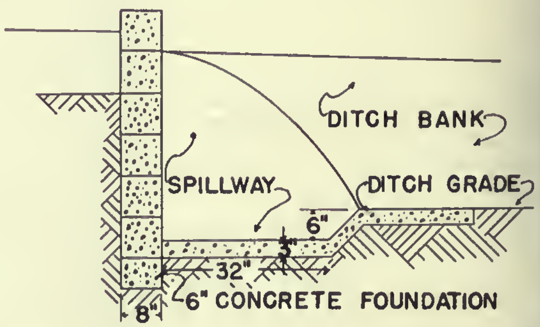
8 - 8"x 8"x 8"	CONCRETE BLOCKS	
20 - 8" x 8" x 16"	"	"
10 CU. FT. CONCRETE		



ISOMETRIC VIEW



FRONT VIEW



SECTION A–A

Drop--Concrete Block

face side of the structure. The basin should be twice the length of the drop and about 6 inches deep. It can be made either of concrete or of rubble mortared together.

Blocks used in the construction should be of dense concrete, not the lightweight type. For best results, all concrete mixes should be 1 volume cement to 2¾ volumes of sand to 4 volumes of gravel, with a water-cement ratio of 5½ gallons per sack of cement. Mortar mixes should be of 1 volume cement to 2½ volumes of sand, or if hydrated is used then on a 1–1–5 ratio of cement, hydrated lime, and sand.

Cost of materials for the concrete block drop will average around $12.50. An overflow type of drop structure—as described here—is not so limited in its capacity as other types of drops, and it may be used as a check structure to take the water from the ditch running down the slope to a lateral. This type of concrete block construction, of course lends itself to the manufacture of various other kinds of drop and irrigation structures suited to particular needs.

If wood is used in the construction of such structures, it should be preservative-treated. ###

(Continued from page 141)

to despair as they faced another winter, the ditch no nearer completion than the year before. Some were growing bitter. The "I told you so's" greeted the workers on every hand. Little children wished on the wishbone for the "big ditch to come."

During these discouraging experiences, the engineer had observed that when this peculiar flour-like shale was mixed with water and allowed to dry it partially regained its rocklike quality. From this he conceived the idea that by soaking the earth down in layers the fills could be made to hold. In spite of previous failures he was able to rally a few indomitable souls. With grim determination, amidst jeers and sneers from those who had no faith in his theory, the work was again gotten under way.

The following spring, with the exception of the major fills the ditch was practically finished, the small fills, the flumes and the excavating around the valley following the general curve of the hills.

As soon as the water could be turned down the Mitchell ditch that spring, the work on the twice-washed-away big fill was recommenced. The method was this: To bring the water as far as the works, to fill in a small amount of earth, then to soak it down with water, again the earth, and again the water and so on. This process became known as "puddling the fills." When this was found to work with complete success and the maximum flow of water was safely carried across on this almost-rock bed, the work was started on the next major fill. Since the work was dependent upon having water close at hand, only one fill at a time could be worked on and only during the summer season.

It was not until the latter part of the following summer, in 1901, that water actually flowed around the foot of Scotts Bluff and out into the ditch beyond. As this life-giving stream wended its way across those well-nigh unconquerable bad-lands, a lusty shout went up from the handful of poverty-stricken, weather-beaten pioneers—hope almost gone from lack-luster eyes, resignation to the inevitable plainly written on their faces. Tears were brushed from many a sun-parched cheek.

New hope had been kindled by the holding of the first big fill and the confidence of the workers. And since spring of that year the early settlers had been laying out distributing laterals. Much of this prairie was feeling for the first time the sharp share of the big four-horse breaking plow turning an 18-inch furrow.

Years later when the engineers in the Reclamation Bureau were working on the Gering-Fort Laramie Canal of the North Platte River project which headed miles up the river, reclaiming thousands of acres of this prairie land, were baffled by the instability of this hardpan in tunneling through this same range of bluffs, they were told to call in the engineer who had put through the Gering ditch—"he knew how to handle the damned dust."

The west wind still plays at will over the Gering Valley, but it now sweeps over broad acres of green alfalfa, waves the golden fields of grain, and rustles the sturdy rows of corn. The water taken from the bountiful supply of the North Platte River never fails to flow from the distributing laterals out over the fertile valley. And it doesn't matter now that the big, black cloud that hangs in the western sky for hours giving promise of rain, ends in just another 3-day blow. ###

(Continued from page 143)

is applied in coarse droplets, using about 35 pounds per square inch spraybar pressure. This, in proportion to the density of vegetation, requires from 100 to 125 gallons per bank mile. Kill from this first application ranges above 90 percent for all plants except sweetclover and the grasses. A second application may be required in the late fall after crops have fully matured. The large acreage of cotton on the project precludes the use of 2,4-D in the summer. 1950 costs averaged $12.98 per mile, while for 1951 and 1952 they were $17.73 and $10.05 respectively for this phase of the work.

Once adequate elimination of willows and large bank weeds is achieved and good ditch-bank roads established, the control of cattails as well as of tules and other types of sedges becomes a comparatively simple problem. Undiluted 32 Diesel oil fortified with 50 percent pentachlorophenol, 2 quarts to each 100 gallons, applied generously in a coarse spray, using 35 to 40 pounds pressure through nozzles with 3/16-inch openings effects a minimum top kill of from 65 to 70 percent of these emergent waterweeds from the first application. Needless to say, all water should be cut off and the channel kept as nearly dry as possible for a period of 36 to 48 hours during and following treatment. Fifteen days later the water should again be drained from the channel to allow for a complete burning of dead canopy. In 2 weeks following the burning the green cattail and tule plants still surviving plus any new shoots are easily accessible and are subject to a repetition of the first treatment. In no instance has two spray applications followed by burning with oil failed to restore adequate channel capacity, but it has been necessary to repeat the procedure three and in one case four times to entirely eliminate those plants on the bank slope proper. Complete eradication of cattails has been obtained in 99 percent of the areas treated.

One striking result of the efforts to date is the rapid invasion of the areas formerly covered by willows by Bermuda, Salt and Johnson Grasses. Summer control was exercised through mowing and spraying with the same oil formula used on cattails, and by oil burning, with the immediate object of preventing rank growth and seeding.

Cost of spraying, burning, and mowing from 1950 through 1952 follows:

Spraying			Burning		Mowing	
Year	Miles	Cost per bank mile	Miles	Cost per bank mile	Miles	Cost per bank mile
1950	71	$37.50	150	$9.25	559	$7.22
1951	278	21.55	341	7.46	228	9.18
1952	478	21.90	371	10.01	128	[1] 18.38

[1] In 1952 mowed both side slope and bank, required 2 trips per bank mile, ½ cost shown compares to costs for 1950—51.

It is believed that the adapted control methods are in the proper sequence to give most encouraging results with a minimum of lost motion and at reasonable costs under our conditions. ###

EDITOR'S NOTE: Since this article was originally submitted to the ERA in 1951 certain revisions were necessary before publication. These have been made by Mr. William C. Brady who succeeded Mr. Postle as irrigation superintendent.

Last Major Contract Let on Coachella Division All-American Canal Project

The last major construction contract on the All-American Canal project area in southern California has been awarded for completion of an 11-mile stretch of concrete pipeline in the Coachella Valley distribution system near Indio, Riverside County, Calif.

The Coachella Valley distribution system is designed to carry water to more than 74,800 acres of rich irrigated farmland from the 123-mile Coachella Main Canal which is a major branch of the integrated All-American Canal project. Construction of the Coachella Main Canal was completed in June 1948.

The All-American Canal project in its entirety serves 425,000 acres of rich desert land in southern California's Imperial Valley, which is one of the most productive areas in the world. The system, approved in 1928 as part of the Boulder Canyon project, includes Imperial Dam and desilting works, the 80-mile All-American Canal, and the Coachella Main Canal.

In 1952, the gross value of crops raised on the project areas totaled $112,608,511 of which $93,394,738 in crops were produced on the Imperial Division, and $19,213,773 on the Coachella Division.

The $519.45 per acre value of crops from the Coachella Division was the highest return from any of the Federal Reclamation projects in the 17 Western States in 1952. •

(Continued from page 145)

ble to plants and not the total phosphoric acid resent that determines its value. Some fertilizrs sold to farmers are represented to contain 25 o 33 percent phosphoric acid but the guarantee nalysis shows only 2 percent available. The omparative value of this material would be aproximately $3 per ton compared with 43 percent reble superphosphate at $63 or 18 percent superhosphate at $27.

Soil fertility in the irrigated districts seems to e closely related to the physical condition of the oil. The fields in good physical condition are he ones that now are growing good crops. Soils vith poor physical condition or soils that have een permitted to deteriorate so that water storng capacity has been lost show a corresponding ecline in yields. The evidence is significant that continued use of barnyard manure or green manure crops or crop residues improve the physical conditions of soils. Ample food nutrients and good physical condition of the soil are the main factors necessary to produce high yields.

Four things—barnyard manure, green manure, crop residue, and commercial fertilizers are the means of maintaining fertility of soils. There are no other means. The first three provide both plant food nutrients and organic matter in varying amounts, while the fourth—commercial fertilizer—provides plant food nutrients only.

Where cash crops are grown, a building up of organic matter is slow. Maintenance of the present level requires care, and a deficiency, once permitted, is a tragedy which is difficult to overcome.

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LETTERS

Required Reading at Columbia

May 12, 1953.

Bureau of Reclamation,
Department of the Interior
Washington 25, D. C.

Dear Sirs: I shall appreciate it very much if you will send me three (3) copies of the following which is being used as required reading for a course n economic geography at Columbia.

The Reclamation Era, August 1951.

Sincerely,

Janet Bogardus,
Librarian, Graduate School of Business Library, Columbia University, New York 27, N. Y.

Thank You And Welcome Back, Mr. Trego

Blackfoot, Idaho
Nov. 21, 1952.

Gentlemen:

I am a retired newspaper publisher, nd I devote a lot of time to flood control and reclamation matters, including ilt deposits in reservoirs, the way to educe them; also the cause and cure of lgae and silt lodging in canals and ditches and the cause and cure of moss orming in canals and ditches in warm veather.

These things all tie in together, and n this locality we have the whole grist n acute form. For 2 years I have been concentrating on the problems, and am ready to prepare a report just after the first of the year that will be of value to this locality and another report, an article more suitable to publish in a Reclamation magazine.

It seems to be quite a live subject, receiving considerable attention or creating anxiety, and I am asking whether I should prepare such an article for you, and if so should I accompany it with any photos of shore lines and disappearing bluffs on our American Falls Reservoir, our principal anxiety here.

In recent years I seldom see your publication and would appreciate being put on your mailing list again.

Yours truly,

Byrd Trego.

DO YOU KNOW . . . .

● The original Newton Dam was the first irrigation storage dam in the State of Utah and possibly the first of Anglo-Saxon origin in the United States? It was built in 1871 using ox-drawn scrapers. Newton Dam, key structure of the Newton project in Utah, was completed in 1946 to replace it.

● Where you can find a reservoir on top of a reservoir? The City of Ogden, Utah, gets most of its culinary water supply from an artesian basin directly beneath the Pineview Reservoir of the Ogden River Project.

● That Parker Dam, with 235 feet of its structure below the Colorado River Bed, is the deepest dam in the world?

● That Davis Dam is named in honor of the late Arthur Powell Davis, one of the early Directors of the Reclamation Service (now Bureau of Reclamation), and father of the Reclamation development of the Colorado River?

● That the 1,400-mile-long Colorado River drains an area one-twelfth the size of the United States?

● That if the Grand Coulee Dam was divided up into souvenir pieces of concrete, there would be a 300-pound piece available for every man, woman, and child in the United States?

● That the Hungry Horse Dam got its name from two horses who were lost and were almost starved to death during winter of 1900–1901?

That the Hungry Horse Dam is the world's fourth largest and third highest concrete dam?

Bound Volumes of ERA

A few copies of volume 33 of the Reclamation Era for the year 1947 are available at $2.50 a copy. These may be purchased by sending a check or money order made payable to the Treasurer of the United States to the Bureau of Reclamation, United States Department of the Interior, Washington 25, D. C.

NOTES FOR CONTRACTORS

Contracts Awarded During May 1953

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contr amou
DS-3868	Davis Dam, Ariz.-Nev	May 4	1 13.8-kilo volt switchgear assembly for Davis Dam transmission system.	Monitor Controller Co., Boston, Mass.	$14,
DS-3885	Central Valley, Calif	May 20	7 vertical-shaft, turbine-type pumping units for pumping plants D1 to D6, inclusive, laterals 115.8W, 118.1W, 119.1W, and 121.0W, Unit 2, Delano-Earlimart irrigation district, Friant-Kern Canal distribution system, schedule 1.	Wintroath Pumps, Inc., Alhambra, Calif.	10,
DS-3885	do	do	14 vertical-shaft pumping units and two horizontal, centrifugal-type pumping units for pumping plants D1 to D6, inclusive, laterals 115.8W, 118.1W, 119.1W, and 121.0W, Unit 2, Delano-Earlimart irrigation district, Friant-Kern Canal distribution system, schedules 2 and 3.	Food Machinery and Chemical Corp., Peerless Pump Division, Los Angeles, Calif.	29
DS-3886	Missouri River Basin, S. Dak	May 12	4 main control board additions for Huron, Mount Vernon, Sioux Falls, and Watertown substations.	Monitor Controller Co., Braintree, Mass.	22
DC-3889	Central Valley, Calif	May 13	Construction of earthwork, pipelines, and structures, including pumping plants, for laterals 115.8W, 118.1W, 119.1W, and 121.0W, and sublaterals, Unit 2, Delano-Earlimart irrigation district, Friant-Kern Canal distribution system, schedule 3.	United Concrete Pipe Corp., Baldwin Park, Calif.	2,588
DC-3890	Missouri River Basin, Nebr	May 29	Construction of Bartley diversion dam	Foley Bros. & Anderson, Inc., St. Paul, Minn.	593
DC-3891	Missouri River Basin, Nebr.-Kans	do	Construction of earthwork and structures for Franklin Canal and drains, schedules 2, 3, and 4.	J. D. Armstrong, Inc., Ames, Iowa	1,152
DC-3895	Columbia Basin, Wash	May 12	Construction of earthwork, piplines, and structures for area E-5 laterals, East Low Canal laterals, schedule 1.	Long Construction Co., Inc., Billings, Mont.	1,79
DS-3898	Palisades, Idaho	May 26	Structural steel, insulated metal wall panels, and accessory materials for Palisades power plant.	California Steel Products Co., Richmond, Calif.	18
DC-3899	do	May 5	Construction of earthwork and structures for relocation of Idaho State Highway 29 (U. S. 26) from Big Elk Creek to Indian Creek, Palisades Reservoir.	S. Birch & Sons, Construction Co., Great Falls, Mont.	49
DC-3900	Missouri River Basin, Nebr	May 29	Construction of earthwork and structures for Bartley canal, laterals, sublaterals, and drains.	Bushman Construction Co., St. Joseph, Mo.	1,09
DS-3902	Boulder Canyon, Ariz.-Nev	May 12	4 vertical-shaft, turbine-type pumping units for pumping plants L-4, L-5, and L-6, Coachella Valley distribution system, unit 8, schedule 1.	Fairbanks, Morse & Co., Kansas City, Mo.	1
DS-3902	do	do	8 horizontal-shaft, centrifugal-type pumping units for pumping plants L-4, L-5, and L-6, Coachella Valley distribution system, unit 8, schedule 2.	Food Machinery & Chemical Corp., Los Angeles, Calif.	1
DC-3904	Palisades, Idaho	May 25	Furnishing and installing 4 30,000-kilovolt-ampere vertical-shaft generators for Palisades power plant.	Pacific Oerlikon Co., Tacoma, Wash	1,97
DC-3907	Columbia Basin, Wash	May 6	Construction of Warden, Warden relift, North Warden, EL61, EL61.7, and EL63.1E pumping plants, area E-5, East Low Canal laterals.	Commercial Builders, Inc., and Duncan Construction Co., Moscow, Idaho.	42
DC-3909	Boulder Canyon, Ariz.-Calif	May 13	Construction of earthwork, pipelines, and structures for lateral 120.8 and sublaterals, part 2 of unit 8, Coachella Valley distribution system.	R. V. Lloyd & Co., Coachella, Calif	59
DC-3910	Cachuma, Calif	May 19	Construction of earthwork, steel pipelines, and structures for laterals 2 to 9, inclusive, Goleta distribution system.	J. E. Young Pipe Line Contractor, Inc., Los Angeles, Calif.	60
DS-3911	Palisades, Idaho	May 29	4 186-inch butterfly valves for Palisades power plant.	Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.	85
DS-3912	Grants Pass, Oreg	May 15	2 16- by 7-foot top seal radial gates and 2 lots of embedded metalwork for Savage Rapids Dam rehabilitation.	DeLaney Co., Houston, Tex	2
DS-3913	Colorado River Front Work & Levee System, Ariz.-Calif.-Nev.	May 20	11 lots of very-high frequency radio equipment for relay stations, schedule 1.	General Electric Co., Electronics Division, Syracuse, N. Y.	1
DS-3919	Missouri River Basin, Mont	May 26	3 32- by 20-foot top seal radial gates for Tiber Dam.	Schmitt Steel Co., Inc., Portland, Oreg.	5
DC-3922	Missouri River Basin, N. Dak	do	Construction of 1 115-kilovolt and 2 230-kilovolt switchyard approaches.	Orlando Construction Co., Coleman, Wis.	14
DC-3924	Missouri River Basin, S. Dak	do	Construction of Winner substation additions	D. L. Varney, Inc., Omaha, Nebr	1
DC-3925	do	May 15	Construction of 20,000-kilovolt-ampere Rapid City substation.	Powerline Construction Co., Nashville, Tenn.	14
DC-3930	Missouri River Basin, Mont	May 29	Construction of Crow Creek pumping plant and steel discharge line, schedule 1.	McClellan & MacQueen, Inc., Worland, Wyo.	12
DC-3930	do	do	Construction of Toston and Lombard Canals and lateral and drainage systems, schedule 2.	Langmo Construction Co., Milltown, Mont.	30
100C-163	Hungry Horse, Mont	May 26	West Side Work Center	Flathead Building Service, Whitefish, Mont.	2
117C-190	Columbia Basin, Wash	May 21	Drains and miscellaneous structures, area E-5	Long Construction Co., Billings, Mont.	[illegible]
117C-191	do	May 27	Residences, garages and utilities, operation and maintenance housing at Ringold.	United Industries, Inc., Richland, Wash.	[illegible]
200C-230	Central Valley, Calif	May 7	Clearing Nimbus Reservoir site	W. D. Zavalas, Oroville, Calif	1
300C-53	Parker-Davis, Ariz.-Calif.-Nev	May 11	Ten residences and 30 garages at Parker Dam Government Camp.	E. W. Scott, Adelanto, Calif	11
300C-54	Boulder Canyon, Ariz.-Calif.-Nev. (Boulder City Municipal Office).	May 26	Plant-mix resurfacing of streets	Ideal Asphalt Paving Co., Inc., Las Vegas, Nev.	[illegible]
301C-4	Boulder Canyon, Ariz.-Nev.-Calif	May 12	Garage at Hoover Dam and foundation for oil and paint storage building at Warehouse No. 2.	Lembke Construction Co., Las Vegas, Nev.	1
400C-40	Provo River, Utah	May 11	Water metering structure for Duchesne Tunnel, station 327-25.	Davis and Butler Construction Co., Salt Lake City, Utah.	[illegible]

Construction and Materials for Which Bids Will Be Requested by September 1953

Project	Description of work or material
ider Canyon, Ariz.-ev.	1 vertical-shaft, Francis-type, hydraulic turbine, 145,000 horsepower at 466-foot head, for unit N-8, Hoover power plant.
tral Valley, Calif.	Construction of Camino conduit involves 5.5 miles of 48- and 36-inch reinforced concrete pipeline, cylinder and noncylinder, or alternative steel pipeline and construction of 2,400 feet of 6-foot horseshoe-type concrete-lined tunnel, located near Placerville, Calif.
Do	Construction of north section of Madera distribution system's unit 3, part 2, requires 21 miles of laterals and sublaterals varying from 85 to 15 cubic feet per second capacity including checks, drops, road crossings, turnouts, division boxes, irrigation pipe crossings, and siphons. Work located 8 miles northwest of Madera, Calif.
orado-Big Thompson, olo.	Grading landscape area, placing topsoil, and installing sprinkler system for system dispatcher s building 5 miles west of Loveland, Colo.
Do	Installation of public service 7,500 kilovolt-ampere transformer bank and 115-kilovolt Yuma bay at Beaver Creek substation near Brush, Colo. Contractor will furnish required steel structures and the Government will furnish the electrical equipment.
umbia Basin, Wash	Construction of 10 miles of drains in lateral area W-3 (block 71) will consist of excavating unlined ditch varying from 15 to 5 cubic feet per second capacities with base width of 3 to 2 feet, and constructing concrete structures, including drain inlets and road crossings. Located about 4 to 10 miles southwest of Ephrata, Wash.
Do	Construction of 12 miles of 555 to 425 cubic feet per second capacity Potholes East Canal of 20-foot bottom width and 45 miles of 72 to 2 cubic feet per second capacity laterals and wasteways of 10- to 2-foot bottom width; and 2.4 miles of 12- to 48-inch diameter pipeline for the remainder of lateral area P-9. Work located about 18 miles north of Pasco, Wash., near Eltopia.
Do	Moving 7 2-bedroom temporary houses from present Government camps to new locations on the W39.9 lateral in area W-6A, the Frenchman Hills wasteway area W-7, Scooteney headworks area P-2, the Babcock pumping plant area W-8, and EL-45 and Lind Coulee wasteway in area E-4, and converting them into houses with basements. Contract includes construction of garages, pump houses, and streets at the new sites and installation of utilities.
Do	Sealing about 4 miles of unlined canal prism on the fourth section of West Canal, about 9 miles south of Quincy, Wash., consists of excavating, replacing with select compacted material, and covering with a gravel blanket.
Do	Construction of a timber county road bridge of standard design, timber superstructure with concrete piers and abutments, across West Cana fourth section extension near Frenchman Hills tunnel. Work also includes barbed-wire fencing, chain-link fencing, cattle guards, and safety screens at several locations along the East Low and West Canals and at the Frenchman Hills tunnel.
Do	Construction of area P-4 (block 13) laterals, sublaterals, and wasteways varying from 288 to 3 cubic feet per second capacities. Work consists of excavating 45.3 miles of unlined laterals and wasteways with base widths of 2 to 16 feet, 14.5 miles of pipeline from 12- to 60-inch culvert and pressure pipe, concrete structures including division boxes, weirs, culverts, drops, 7 small pumping plants, and 3 bridges.
Do	Placing floor finishes in a 4,200-square-yard area of Grand Coulee pumping plant at Coulee Dam, Wash., and installing 6,000 feet of base and 1,000 feet of curb.
vis Dam, Ariz.-Nev	Addition of 1 115-kilovolt bay to high-voltage bus structure including high-voltage switching equipment installation, and installation of an additional 8,000/10,000-kilovolt-ampere OA/FA unit substation, and addition to 12.5-kilovolt bus structure at ED-2 and ED-4 substations between Casa Grando and Eloy, Ariz. Steel structures and electrical equipment will be Government-furnished and the contractor will remove the unit substation for ED-4 from Maricopa substation.
vis Dam, Ariz	Installing static-capacitor, wood-pole structures and chain link fence near Boundary pumping plant 5 miles south of Gadsden, Ariz.
Do	50,000 pounds of fabricated, galvanized structural steel for bolted switchyard structures, ED-2 and ED-4 substation additions.
Do	35,000 pounds of fabricated, galvanized structural steel for bolted switchyard structures, Coolidge substation additions.
Do	50,000 pounds of fabricated, galvanized structural steel for bolted switchyard structures, Oracle substation.
Gila, Ariz	Construction of unit 2 of Wellton distribution system, which will irrigate about 7,700 acres surrounding Wellton, Ariz., consists of 26 miles of unreinforced concrete-lined laterals, 9 miles of wasteway channels, 3 jacked-pipe railroad siphons, and checks, drops, pipe road siphons, turnouts, bridges, deliveries, and wash siphons. Contract includes furnishing and laying 1 mile of 30- to 54-inch diameter concrete pipe, about 360,000 cubic yards of lateral and structure excavation, and 400,000 cubic yards of channel and dike excavation.
Do	Construction of about 22 miles of unreinforced concrete-lined laterals and sublaterals of 45 to 15 cubic feet per second capacities for unit 4 of Mohawk distribution system near Wellton, Ariz.
Hungry Horse, Mont	Treating roofs of 75 camp buildings and painting interiors of administration building and conference hall near Columbia Falls, Mont.
Do	Modification of dormitory, insulating interior of Imhoff tank building, and electrical installation in 6 multiple-stall garages near Columbia Falls, Mont.
Do	Constructing concrete walks and steps for 46 prefabricated residences near Columbia Falls, Mont.
Kendrick, Wyo	Furnishing and placing about 4,500 feet of earth or buried asphaltic membrane lining on Casper Canal in Natrona County about 28 miles southwest of Casper, Wyo.
Do	Furnishing and placing about 13,000 feet of buried asphaltic membrane lining for laterals 256 and 218, and furnishing all materials except bentonite, and placing about 3,600 feet of buried bentonite membrane lining for laterals 156 and 256-27, in Natrona County, about 7 miles west of Casper, Wyo.
Middle Rio Grande, N. Mex.	Channel rectification work on the Rio Grande in the area of San Antonio, Escondido, and San Acacia, N. Mex.
Missouri River Basin, Kans.	Completion of Webster Dam on the south fork of the Solomon River about 1 mile downstream from Webster, Rooks County, Kans., includes the following work: Completion of earth-fill dam 110 feet high and about 11,000 feet long at 30-foot wide crest. Upstream slope will have riprap protection. (Foundations of portions of dam are under construction.) Construction of earth-fill dike on left abutment, 20 feet high and about 2,000 feet long at 30-foot wide crest. Construction of concrete outlet works consisting of an intake structure, a 220-foot long, 4.5-foot diameter conduit, a gate chamber, a 270-foot long, 8-foot horseshoe conduit with steel pipe, a control structure, stilling basin, and a riprap-protected outlet channel. Construction of concrete spillway consisting of a crest structure 116 feet wide controlled by 3 radial gates 33.33 feet by 39.08 feet, a 658-foot long chute, stilling basin 264 feet wide by 130 feet long, and a riprap-protected outlet channel.
Do	Construction of 7 miles of unlined laterals and drains of 18 to 6 cubic feet per second capacities and unreinforced concrete structures for Courtland Canal's second section near Mankato, Kans. Involves about 69,000 cubic yards of excavation.
Missouri River Basin, N. Dak.	150,000 pounds of fabricated, galvanized structural steel for 115-kilovolt single-circuit towers, Garrison-Voiaire transmission line approach to Garrison switchyard.
Tucumcari, N. Mex	Construction of about 4 miles of scattered drains and rehabilitation of one existing drain and related structures near Tucumcari, N. Mex. Work also includes a small amount of canal and lateral lining.
Vermejo, N. Mex	Rehabilitation of Vermejo diversion dam, 11 miles of 600 cubic feet per second Vermejo Canal, and 24 miles of 300 cubic feet per second Eagle Tail Canal, 8 miles northwest of Maxwell, N. Mex., includes: Revising diversion dam headworks structure by lowering gate sills, blocking the 9 existing openings, enlarging the outlet structure to 450 cubic feet per second capacity, and installing 9 new slide gates Existing sluice gates will be replaced by 3 new slide gates with some earth dike and bank riprap protection. Canal and channel excavation, new sluiceway, siphons, wasteway drops and drainage inlet structures for the Vermejo Canal. Canal excavation, 1,400 feet of Kellner-type jetties, 1,800 cubic yards of dumped riprap on river bank, gate-controlled sluiceways, checks, siphons, and drop structures for Eagle Tail Canal.
Yakima, Wash	The 6.6 miles of 500 cubic feet per second capacity Chandler Main Canal, Division 1, and 0.6 mile of 435 cubic feet per second Kiowa wasteway to be constructed near Prosser, Wash., will be concrete-lined for 1 mile and unlined for the remainder.
Do	2 railroad undercrossings to be constructed on the Chandler power canal will be monolithic reinforced concrete siphons, 1 415 feet long and the other 320 feet long, under railroads 4 and 6 miles east of Prosser, Wash. Each siphon is to have 2 11.5-foot inside diameter barrels and inlet and outlet transitions.

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*See note on page 137 regarding California Projects Organization.

U. S. GOVERNMENT PRINTING OFFICE: O—1953

The Reclamation Era

October 1953

IN THIS ISSUE:

Official Publication of the Bureau of Reclamation

The Reclamation Era

OCTOBER 1953 Volume 39, No. 8

IN THIS ISSUE . . .

Special Notice to All Subscribers

The July 1953 issue of the Reclamation Era was the first under our new quarterly publication schedule. This is just a reminder in case you missed the special notice in the July issue.

Subscription rates for the quarterly publication are 50 cents per year, with 15 cents additional required for foreign mailing. Separate copies may be purchased for 15 cents each. Under the new policy all subscriptions should be sent direct to the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Requests for changes in mailing address should also be sent direct to him.

Subscriptions now in force will be extended for a maximum period of 2 years from last July. If, at the expiration of that time, subscribers have not received all copies due them under the previous subscription rate, a refund will be made by the Superintendent of Documents.

WATER FORECAST

THE NEXT QUARTERLY ISSUE of the Era, due in January, will appear in February, and each subsequent quarterly issue will be advanced by one month, i. e., May, August, and November. This change in schedule is necessary in order to continue our spring and fall features, namely, WEST-WIDE WATER FORECAST (May issue) and WATER REPORT SUMMARY (November 1954 issue).

The Summary will not be published this fall. However, the foregoing change in issues will permit us to get back on schedule and bring you both the Forecast and Summary.

DESIGN AND ILLUSTRATIONS by Graphics Section
Bureau of Reclamation, Washington, D. C.

J. J. McCARTHY, Acting Editor

Issued quarterly by the Bureau of Reclamation, United States Department of the Interior, Washington 25, D. C. The printing of this publication was approved by the Director of the Bureau of the Budget, May 5, 1953.

WILBUR A. DEXHEIMER of Denver, Colo., popularly known as "Dex," and a Bureau engineer for 25 years, is the new Commissioner of Reclamation. After his promotion by appointment of President Eisenhower on July 13, he took the oath of office in the office of Interior Secretary Douglas McKay who had recommended him to succeed Michael W. Straus, who resigned in February. Under Secretary of the Interior Ralph A. Tudor with whom he had worked in China introduced the new Bureau Chief.

On July 14, the new Commissioner was individually welcomed by all of the employees of the Washington office of the Bureau. On July 15, he joined Secretary McKay in Denver where the latter inspected Reclamation offices and facilities, and addressed employees on July 16.

A career employee, Commissioner Dexheimer has been with the Bureau of Reclamation since 1928, with the exception of 4 years he served as an officer with the Corps of Engineers during World War II, and a year with an American engineering firm in China as a consultant.

Born in Denver, Colo., in 1901, he attended the

W. A. DEXHEIMER

The New Commissioner of Reclamation

University of Denver, and later the Colorado A and M College where he received his Bachelor of Science Degree in Civil and Irrigation Engineering in 1926. Concurrent with college attendance he worked for the Denver and Rio Grande Railway, and on graduation served as assistant city engineer for Fort Collins, Colo., and as location engineer for the Union Oil Co., before joining the Bureau of Reclamation in 1928. On his first Reclamation job he was chief of survey party, locating canals, tunnels, and structures on the Kittitas Division of the Yakima Project at Ellensburg, Wash. In 1929 he worked on the location and topographical survey of the Boulder Dam Project. From 1931 to 1936 he was an engineer on construction of Hoover Dam and Power Plant. He also served as Field Engineer on the Bartlett Dam, Salt River Project in Arizona. Following this, he was assigned to Shasta Dam on the Central Valley Project until 1942, when he became a captain in the Corps of Engineers. He served until 1946, when he was honorably discharged as a lieutenant colonel. His principal service was in China, including a detail as assistant theater engineer in the China-Burma-India theater. He was decorated with the Bronze Star, and is one of four Americans to receive the Chinese Order of White Cloud.

After leaving the military service, he became consulting engineer for the Morrison-Knudsen International Co., and participated as assistant chief engineer in planning rehabilitation of railroads, highways, and ports in China.

In 1947 he returned to the Bureau of Reclamation at Denver and served as Assistant Chief Construction Engineer until his appointment as Commissioner. During this period (1947–53) he was detailed to the State Department as a consulting engineer for investigation and planning of

Please turn to page 174

LAND OF HOPE—thanks to irrigation. *Stan Rasmussen photo.*

OPENING NEW FRONTIERS

By L. R. SWARNER, Irrigation Engineer, Region 1, Headquarters, Boise, Idaho

"The names of 72 lucky war veterans were drawn today for farm units on the North Side Pumping Division of the Minidoka Project. These farm units, which average 100 acres of fertile irrigable land, are the first block of an ultimate 700 homestead units to be furnished water by the Bureau of Reclamation through pumping, largely from underground water." Thus read a part of a news item in a local paper on August 4, 1953. Truly those receiving farm units were lucky, for a total of 4,431 names were in the hopper at the time of the drawing. Lucky? Yes, but not in the sense that they are receiving a gift on a silver platter, but because of the opportunity afforded them to develop and own an irrigated farm through hard work and sacrifices. But let's get the story behind the story and see why those receiving farm units are really lucky. Let's look at the planning and work which preceded and made possible the successful drawing.

Lands of this Division as authorized by Congress, are in 2 units comprising approximately 77,650 acres of irrigable land in the Snake River Plain and are perhaps the most fertile remaining undeveloped in Region 1. Detailed investigations were necessary for the two essential components of a successful irrigation project—good land and a good water supply. This irrigable area was selected from a large body of land withdrawn for reclamation as being well suited for irrigation as the result of a detailed land classification. The feasibility of pumping water from 150 to 200 feet demanded that the standards for land classification be held high and that only the best lands be provided with a water supply. The selection of the project area was the result of an integrated analysis of lands based on both physical and economic factors.

Unit A, comprising approximately 13,650 acres of irrigable land, will receive its water through a pumping plant located on the Snake River in the backwaters of Milner Dam. The water will be pumped into an open lateral system approximately 158 feet above the elevation of the water in the river. The completion of the Palisades Reservoir, now under construction, located near the headwaters of the Snake River with an active storage capacity of 1,200,000 acre-feet, will insure an adequate water supply for this unit.

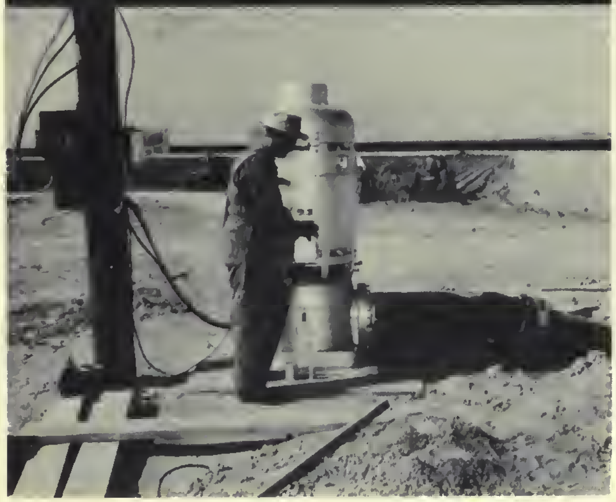
The water supply for the 64,000 irrigable acres in Unit B will be provided from approximately 131 wells tapping the "Lost River" which presumably flows underground 150 to 200 feet below the surface of Snake River Plain. (Reclamation Era—April 1951—"Tapping Lost River"). Many questions had to be answered as to the amount, depth, and availability of the underground supply. To answer these problems, the Bureau of Reclamation began drilling and testing wells in this area in 1948. Already privately owned land adjacent to, and within, the Division boundaries have been developed at a rapid rate until approximately 23,000 acres were irrigated from ground water by private owners in 1951.

In the initial development, the lack of adequate information on the water supply demanded that the supply be tested before the land was opened to public entry. To accomplish this, the raw lands in sagebrush were leased on a competitive basis to private individuals. These individuals were required to clear, level, and farm the land, thus utilizing the water pumped from the wells. Approximately 5,000 acres of the 7,200 in the 72 farm units are presently under full production. The leases for this land expire at the end of this crop season, and the entrymen will take over. The veterans receiving these units will be especially lucky.

From the information secured from the 10 irrigation wells and several observation wells and from the records of the United States Geological Survey as to the ground-water table in the area, it now appears that there is no necessity for testing the irrigation wells for several years before opening the land to public entry. The project water supply will, of course, be under continual observation during the development period.

The policy of establishing family-sized farm units whereon an entryman can maintain an adequate standard of living for his family and meet the construction and operation and maintenance charges is especially important on this project, since the operation and maintenance charges due to the high pumping lift will be considerable. A careful study of the size of farm unit has been made to insure the entryman of a successful future if he follows good agronomic practices. The size has been determined after a careful study of the agricultural economy of the area and this varies proportionately with the classes of land found in each unit. The present size has been concurred in by the Extension Service and Agricultural Experiment Station of the University of Idaho, and the

STEP NO. 1—Remove heavy brush covering fertile land. ***Phil Merritt photo.***



WELLS TESTED with diesel motor (top photo). Pumps with electric motors pump 4,500 gallons per minute from depth of 230 feet (above). ***Top Photo by Phil Merritt, above photo by Stan Rasmussen, both of Region 1.***

Farmers Home Administration of the Department of Agriculture.

The actual layout, survey and acreage determination of the farm units to meet these requirements is the biggest job in getting the units ready for entry. Preliminary boundaries are laid out on topographic sheets on which the land classification has been transposed. When advantages can be gained from the standpoint of farm organization or operation and irrigation deliveries, departure is made from the rectangular survey or regular subdivision. This requires careful study of the general irrigation plan for each unit and often creates problems regarding the location of roads which normally are found on section lines. The relocation of roads requires close cooperation with the local road districts, since it is necessary to obtain their approval of any road plan which deviates from the normal procedure. Where no particular advantage is to be gained from following topographic boundaries, regular legal subdivisions are used for boundaries. After the farm units have been laid out on paper, concurrently with the wells and necessary laterals, a careful check is made of the farm unit boundaries in the field. This generally results in greater refinement and insures proper location of the laterals and farm unit boundaries.

The use of topographic features for unit boundaries requires that a supplemental survey of the tracts be made and be described by a metes and bounds description. This requires considerable more work than if legal subdivisions were used, but the benefits derived through better farm organization and operation over a period of years far exceed the cost of the supplemental surveys. Thus, considerable difference results in the shape of the farm units on the newer farm unit plats as compared to the old farm unit plats as show in accompanying illustrations.

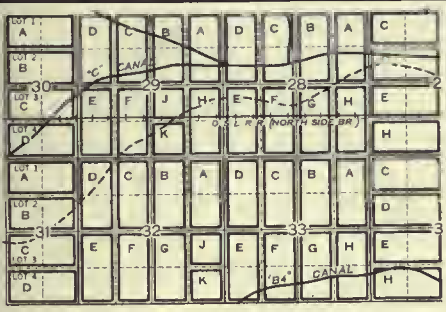
Among the most convincing facts to bear out the fact that the entrymen are lucky are the records of production obtained from these lands during the period they have been leased. Per-acre yields as high as 55 bushels of barley, 45 bushels of dried peas, 21 tons of sugar beets, 15 sacks of beans, 300 sacks of potatoes, 70 bushels of wheat have been obtained on this new land. Accurate records of development cost, water use, fertilization, and soil management have been obtained during this period of leasing in order to substantiate the data used in setting up the size of farm unit and the water requirement.

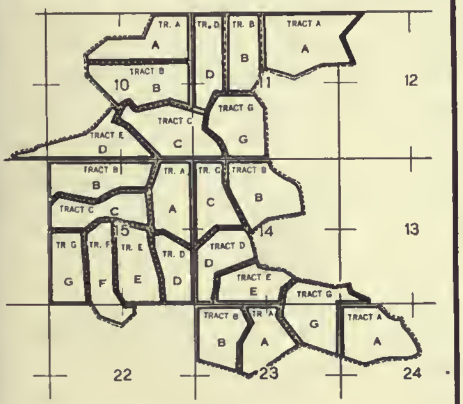
Thus we see that, unaccompanied by publicity and fanfare, a tremendous amount of work and effort has preceded the public drawing. This work and planning is the insurance policy that protects the entryman who receives the farm unit. He is indeed lucky, as it has been demonstrated that, with the proper agronomic practices, he will be able to make a success on the lands of the North Side Pumping Division, thus bringing to pass the vision of agricultural development many local residents have had for more than 40 years.

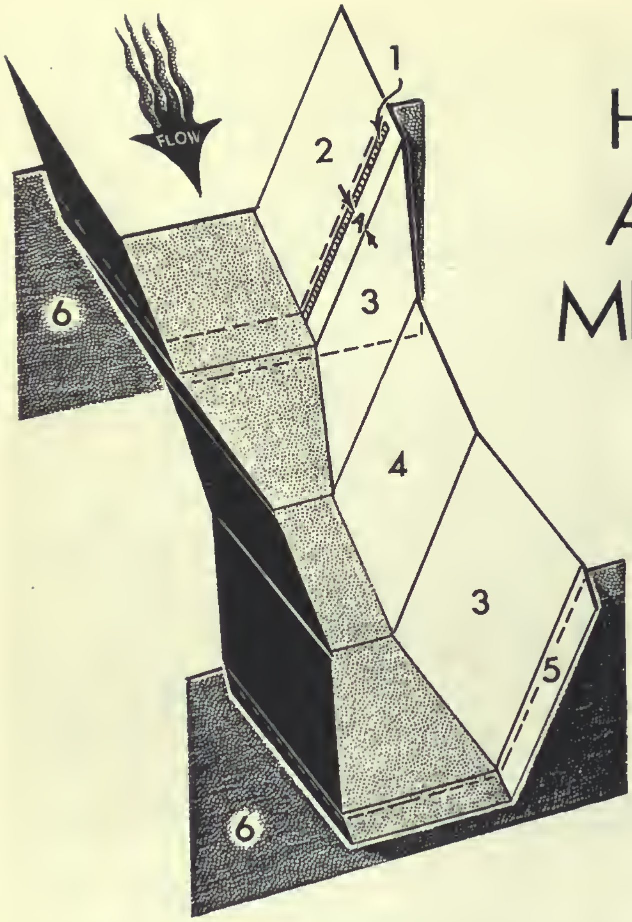
# # #

COLD, CRYSTAL CLEAR, pure water for irrigating this land comes from deep down in the earth below the desert (at left). Immediately below, irrigating dry beans by sprinkler system on North Side Pumping Division, Minidoka project. Next, Arnold M. Critchfield checks flow of irrigation water into a small lateral on his potato field. Bottom photo, EVIDENCE OF PRODUCTION BY IRRIGATION. *First three photos by Phil Merritt, bottom photo by Stan Rasmussen, both of Region 1.*

1st Map shows farm unit based on rectangular surveys. Map at bottom of page—farm units based on topographic and land capability survey.







HOW TO BUILD AN INEXPENSIVE MEASURING FLUME

Based on information contained in a paper by ADRIAN R. CHAMBERLAIN, Graduate Research Assistant, Agricultural Engineering Department, Washington State College

Year by year experts are learning more and more about the amounts of water needed for maximum production of various crops. If you're a farmer who wants to keep pace with the experts and capitalize on this new knowledge, the logical step is to find a way to accurately measure the amount of water you provide your crops.

A simple water-measuring device, developed by Washington State College and named "The WSC Flume," may be what you're looking for. Not only does it offer an easy and accurate way to measure water, but it's also easy to build and install, and inexpensive.

The Extension Service of the College has devised a standard pattern which can be varied in size to make the flume with a capacity of 15 to 100 gallons per minute; or 50 to 1,200 gallons per minute.

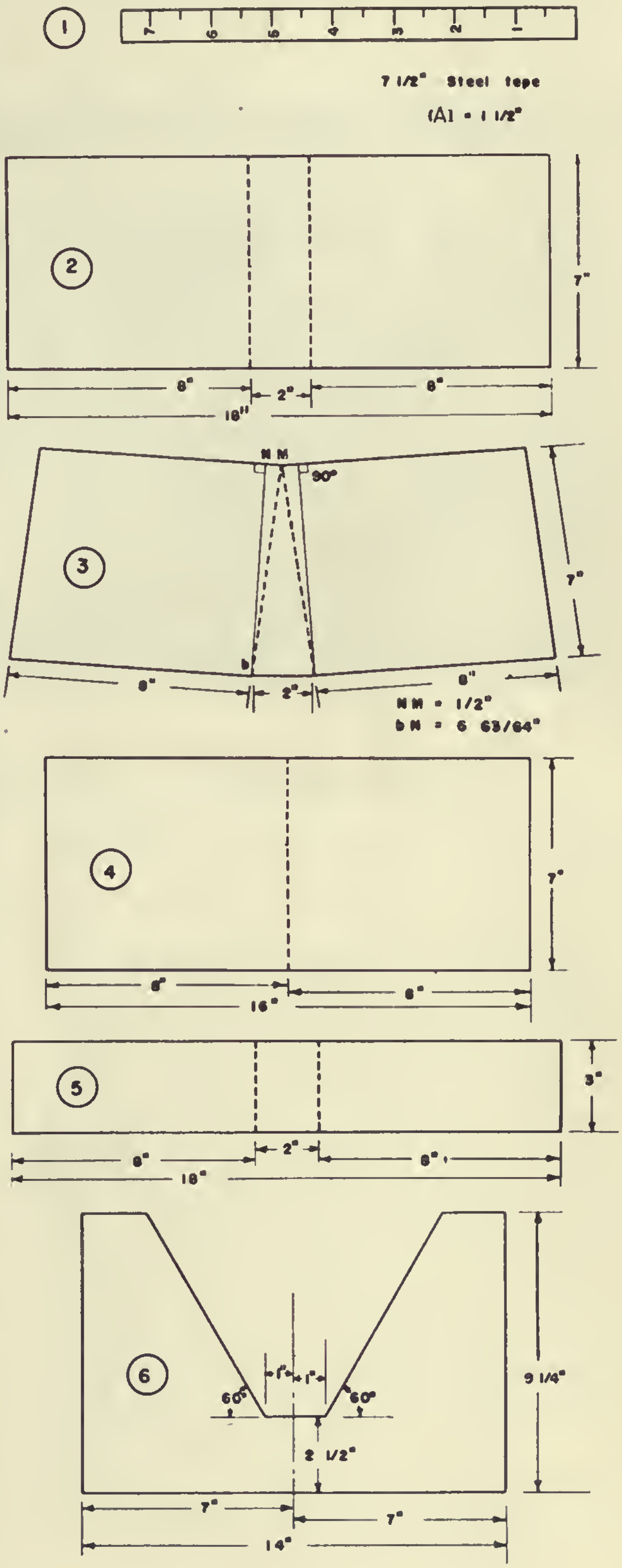
All the flume's seven sections can be made from four simple templates. They are assembled together and easily transported to the field and installed. A scale, graduated in eighths of an inch, provides a means of measuring the water.

Sheet metal is recommended in making the flumes, since it makes the finished product easy to install and easily portable. The flume requires little material. The 15 to 100 gallons per minute flume requires a 3- by 2-foot sheet of 20-gauge metal for the flume, a 2- by 1½-foot sheet of 16-gauge for the cut-off walls, and a 7½-inch plastic or steel scale. The larger, 50 to 1,200 gallons per minute flume involves a 4-foot by 7-foot sheet of 16-gauge metal or heavier for both flume and cut-off walls. Its rule should be 15 inches long, graduated in eighths.

Lumber can be used in the construction, provided it is finished on one side and both edges, and all edges or corners which protrude into the channel are rasped or planed off. Inside dimensions of wood or concrete construction should match the dimensions on the diagrams. Concrete construction makes a permanent installation. If concrete is used, however, the inside surfaces should be a smooth mortar plaster finish.

Once the parts are cut from the metal, they may be put together by soldering, if you're making the smaller flume, or by arc welding if it is the larger flume. The flume can be fabricated in a number of ways, but it's suggested that a tinsmith or sheet-

At right, layout plans for flume with capacity range of 15 to 100 gpm. Note: Dashed lines indicate bends 60° from horizontal. See next page for larger capacity flume layout plans.



metal worker do the work or be consulted. Care should be taken to make sure the inside of the joints is smooth.

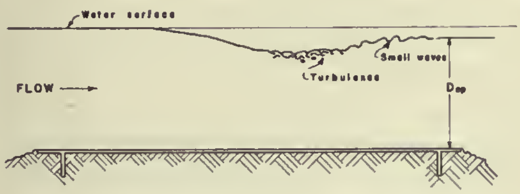
The only requirement for correct field installation is that the bottom of the flume must be level, both across and along the flume. The floor of the flume should be level with or—preferably—slightly above the bottom of the ditch.

One precaution must be observed if the flume is to give accurate results. It is not operating when "drowned out." If the water surface is a common level upstream, through and below the flume, it is drowned out. If the flume is not working, or if there is any doubt that it is, you should either (1) raise the entire flume a bit; or (2) clean the ditch for a short distance downstream so that the water is not dammed up as much below the flume.

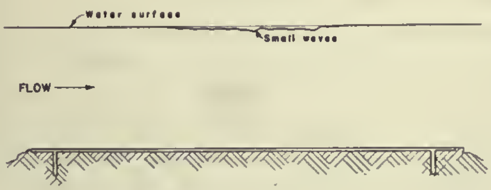
The WSC flume can be used in nearly any ditch that has a slope of less than a half-foot per 100 feet, which gives it a distinct advantage over most other measuring devices which can't be used on a flat slope of one-half percent or less.

Once the flume is properly constructed and the water flow is under way, simply read the scale in inches and calculate the volume of flow on the curve.

Properly constructed, the WSC flume is not only accurate and easy to install and operate, but it offers a larger range of capacities and smaller head loss than weirs and other similar devices. # # #

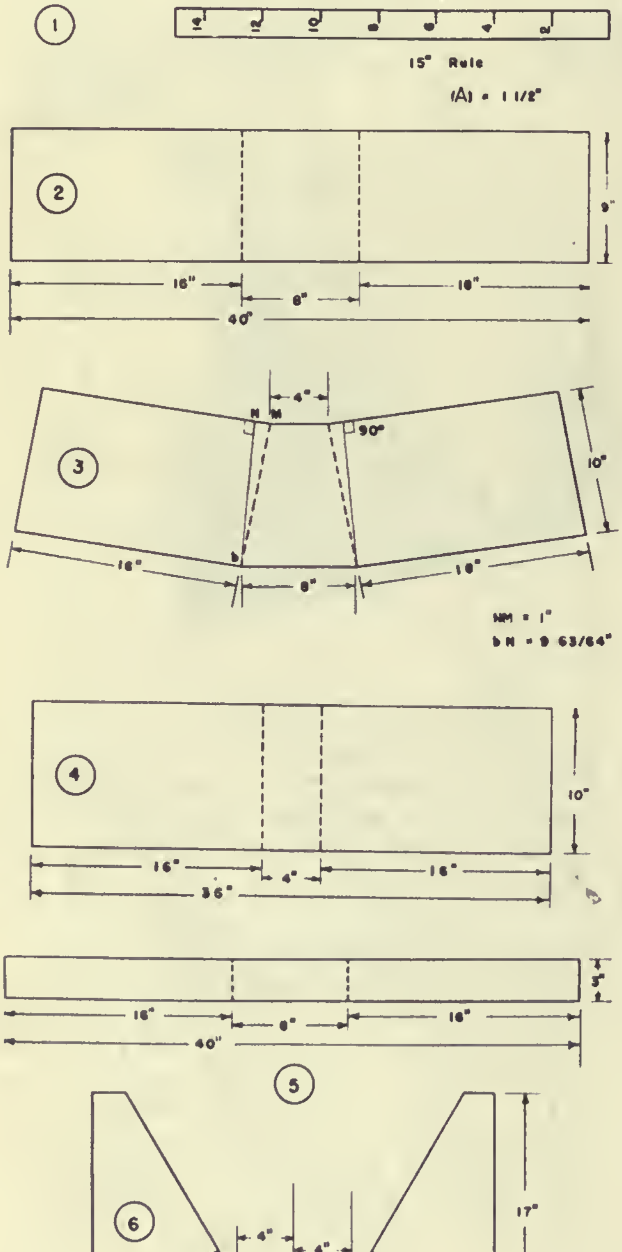


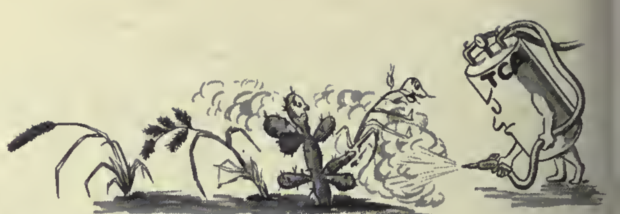
Operating



Drowned out

Layout plans for flume with capacity range of 50 to 1,200 gpm. Note: Dashed lines indicate bends 60° from horizontal.





SECOND ANNUAL "WEED HOLIDAY"

Three hundred and fifty members of the families of farmers and businessmen on the North Unit of the Deschutes Project in central Oregon on last June 9 combed an estimated 200 miles of irrigation canals and roadside and rogued out hundreds of noxious weeds offering a threat of pollution to the dominant small seeds crop.

The mass activity of weed destroyers constituted the second annual Jefferson County "Weed Holiday" (see Deschutes "Weed Holiday," p. 210, September 1952, Reclamation Era), an activity launched by a number of groups in the 50,000-acre irrigation district to make the entire population conscious of the economic threat of noxious weeds.

So far as is known, it is the only such holiday of its kind in the nation. Dr. A. H. Stewart of the Oregon State College herbarium, who was present at the affair, declared in an address to the group that he knew of no other place in the world where such an intense interest in weeds is taken as on the Deschutes Project.

An award was offered for stumping Dr. Stewart and Dr. Gilkey, which was won by Bruce Nicholes.

Participating in sponsoring the "Weed Holiday" were members of the North Unit Irrigation District, Jefferson Seed Growers Association, Jefferson County extension service, Madras-Jefferson County Chamber of Commerce, Jefferson County Cooperative Association, the U. S. Bureau of Reclamation, and various private business concerns serving the small seeds industry.

A delegation from nearby Yamhill County was present to observe how the holiday works. Members said they propose to launch a similar program there to protect the small seed crops from an invasion of noxious weeds. Dr. Helen Gilkey also of the Oregon State College herbarium expressed the hope that the campaign started on the new project would spread to the rest of the state. #

Do Sprinkler Irrigation Systems Pay?

By ROLAND C. BEVAN, Associated Agricultural Economist, University of Idaho Agricultural Experiment Station

Above: General view of the L. H. Peters farm, in the Willamette Valley, Oreg., under sprinkler irrigation. ***Photo by Stan Rasmussen, Region 1.***

Farmers considering an investment in a new machine or a new building try first to answer the question, "Will it pay to do this?" This question arises for example when considering the purchase of a beet harvester or a hay chopper or the purchase of a sprinkler system.

How can this question be answered? By comparing the estimated annual costs of the item with the estimated added income resulting from its use. The costs will include those arising in the year of use and the initial cost spread over the estimated life of the item (we call this depreciation). Interest on the investment must also be included even if no money is borrowed to make the purchase. The returns should be figured at the prices expected over the life of the item. One must use expected future prices, rather than present or past prices. This is because the investment must be paid for out of future income. Naturally, if future prices are expected to be high, it will be easier to pay for the purchase. On the contrary, if they are low, it will be much more difficult to do so.

What are the costs and returns from the use of a sprinkler system? Some information is available on sprinkler costs but practically nothing on the return side. The returns would be the added incomes due to increased yields or to the production on land which could not previously be irrigated. This added production would be valued at expected future prices.

Some guides to the costs of sprinkler systems are found in the material obtained by the Idaho Agricultural Experiment Station from 61 farmers in 1948 and 1949.[1]

[1] Summarized in Idaho Experiment Station Bulletin 287, *Costs of Sprinkler Irrigation on Idaho Farms*, Max C. Jensen and Roland C. Bevan.

In this study the annual costs of sprinkler systems were found to be $18.95 per acre for systems obtaining water from free sources, and $18.20 per acre for systems buying water from an irrigation company. Few farmers had average costs. Most of them had higher or lower costs than those cited. The size of the area sprinkled was probably the most important influence on cost. Systems sprinkling 25 acres or less showed an average annual cost of $26.83 per acre. Those sprinkling 50 acres or more on the other hand had annual costs averaging $16.09. Little difference was found between the annual costs of systems obtaining water from free sources (as a well, pond, stream or lake) and those buying water from an irrigation company. This is because the systems obtaining water from free sources were forced to invest in more expensive installations to lift or transport their water to field level. The individual items of cost for the two types of installations are shown below:

Average Annual Costs Per Acre for Sprinkler Irrigation, Idaho, 1948–49

Item of cost	Free-water source	Purchased-water source
Depreciation	$6. 90	$4. 40
Interest on investment	2. 60	1. 65
Water	0	3. 55
Repairs and maintenance	. 40	. 25
Power	3. 75	3. 10
Labor	5. 30	5. 25
Total annual cost	18. 95	18. 20

Depreciation is the initial cost spread over the estimated years of life of the systems. On the average, farmers estimated these systems would last 15 years but the range of estimates was from 10 to 40 years. If the system lasts 30 years the annual depreciation is only one-half that on one lasting 15 years. This estimate of life was difficult to make because none of the systems had worn out yet. Lower per acre depreciation costs were found for the larger systems, the less elaborate systems, and for those used on regularly shaped tracts of land. Note that the depreciation cost is 50 percent greater for the systems using water from a free source.

Interest on the investment is calculated at the going rate of interest on one-half the initial cost. Since the system decreases in value over its life from the initial cost to nothing, the average valu is halfway between or one-half the initial cost The average interest rate paid was 5 percent, s this rate was applied to one-half the initial cos to obtain the interest charge. This will vary fo much the same reasons the depreciation varies Lower interest charges will result from using th system on a larger acreage and from less elaborat and less expensive installations.

Water when purchased will be included at th cost per acre of obtaining it from the irrigatio company. Those systems using water from a fre source will of course not have this cost.

Repairs and maintenance are a small item fo a sprinkler system. Couplers and sprinkler head may need replacement and some repairs may b necessary for pumps and motors. This cost wa especially low for these systems because they wer new and few repairs were needed as yet. Highe costs would be expected as the systems becom older, but these will still be only a small part of th total annual cost.

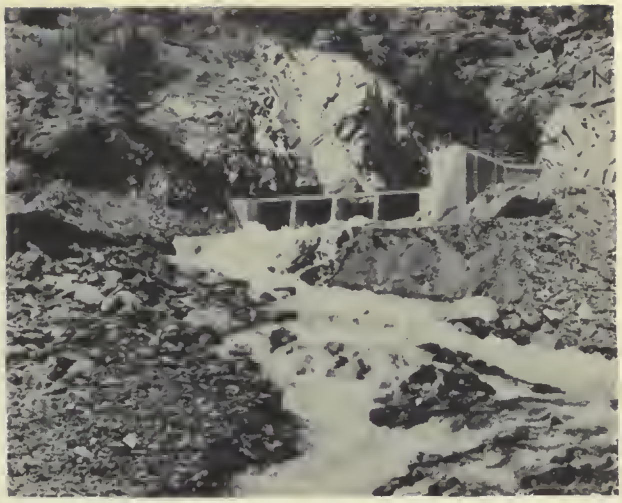
The power cost is merely the amount paid fo electricity used to pump water through the sys tems. The cost per kilowatt hour averaged 9 mill but was lowest for the systems using more kilowat hours per month. The power cost varied of cours with the number of irrigations and amount of wa ter applied. It also varied with the lift to fiel level and the pressure per square inch in th system. A few farms used gas engines for pow instead of electricity. On these farms the annu costs of operating these gas engines would be su stituted for the charge for electricity.

The labor moving the sprinkler pipes average nine-tenths of one man hours per acre per ir gation. This is almost exactly the same char obtained in previous studies in Idaho for lab irrigating by surface methods. This charge f labor varied with the number of irrigations. T value of the labor was figured at 75 cents per ho to obtain the cost shown.

As can be seen, costs vary widely between farm Published data, such as that cited above is a gui to farmers who seek to estimate what their ow costs would be. They should, however, use t costs for their own situation. Figures such those shown are merely a guide in making such estimate. By comparing the annual costs per a with the expected increase in income per acre t farmer can answer the question—Will sprinkl pay? # #

INGENUITY saved the crops

By WILLIAM A. PRICE, Agriculturalist, Region 7, Bureau of Reclamation, Denver, Colo.



BIG THOMPSON PROJECT water by-passing Pole Hill Power Plant en route to Little Hell Creek. *Photo by Roy Anderson, Greeley Daily Tribune Staff.*

Drought didn't ruin the late maturing crops on approximately 75,000 acres of fine northeastern Colorado farmland this past summer, thanks to what farmers in the area have dubbed the "back door" method of irrigation water delivery.

The novel method of getting water from the still incomplete Colorado-Big Thompson Project onto the drought-threatened farmlands involved working out a unique bypass around the unfinished project works, utilizing a creek, a river, two irrigation canals, four diesel pumps, and some good old-fashioned team work.

It all began back in March 1953, when the secretary-manager of the Northern Colorado Water Conservatory District announced that 100,000 acre-feet of Colorado-Big Thompson water was available for supplemental irrigation. The announcement evoked mixed emotions in northern Colorado farmers. Those owning farms under the Cache la Poudre and Big Thompson Rivers could and did place their orders for the water, rounding out their needs for the season. But others, whose lands lay just to the south and are served by ditches originating from the Little Thompson and St. Vrain Rivers, received the announcement with bitter disappointment.

They reacted thus because the St. Vrain Canal, which will carry Colorado-Big Thompson Project water to them, is not scheduled for completion until the spring of 1954. Meantime, it appeared there was no feasible way to get the water during the 1953 growing season for late irrigation of sugar beets and corn.

That's where the "back door" delivery system came in. Water from the Big Thompson Project was diverted at a point high in the foothills of the Colorado Rockies. The water was turned, instead of into the penstocks of unfinished Pole Hill powerplant, over the boulder-strewn side of the mountain into a gulch draining into Little Hell Creek.

In turn, Little Hell Creek conducted the man-made torrent into the Little Thompson River. Thence it was diverted by the Ish Ditch Company into the Ish ditch and conducted out into the farming area on the plains east of the foothills.

But still other farmers to the south didn't have a source of supply. So a sump was dug and four diesel pumps installed at a point where Ish Canal is near to the Highland Canal. From the Ish upward almost 30 feet to the Highland went the precious water, by pump, and from the Highland to the farmers who had not pictured earlier in the season how they could possibly acquire any Colorado-Big Thompson Project water in 1953.

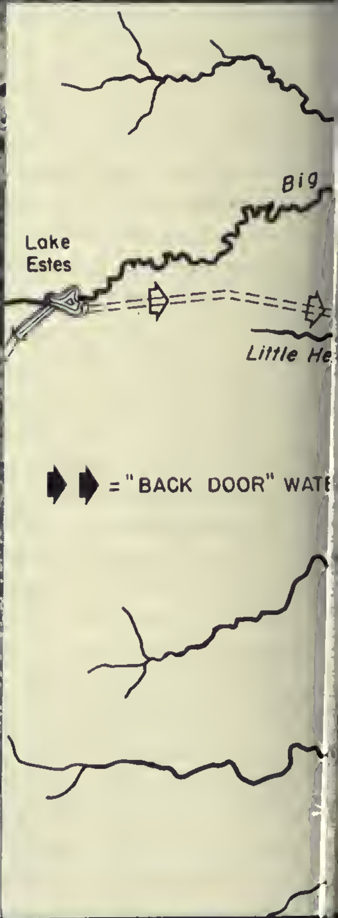
Altogether, this arrangement and water exchange made possible the delivery of 18,580 acre-feet of additional water to farmers under the Ish and Highland Canals. Late maturing cash crops were saved from drought.

What this meant to the farmers was summed up by one of them, John K. Schell, who lives near Mead, Colo. He said:

On July 5, I was informed that I had 167 inches of water left to my credit. That was just enough to irri-

Please turn to page 165

(1) Water standing in Pole Hill Canal. Gate in structure shown was lowered so water would rise high enough to overflow into bypass. (2) Water headed for Little Thompson River flowing from the overflow structure in gate house above Pole Hill Penstocks and down steep bypass to Little Hell Creek and Little Thompson River. Diversion provided supplemental irrigation to Little Thompson River and Highland Ditch. (3) at top, Colorado Big Thompson water which bypassed Pole Hill Plant enters pump sump from Ish Ditch. Four diesel engines and 10" suction pumps are beneath pipes. Note Highland Ditch wasteway, upper left. (3) below, pumped water from Ish Ditch entering the Highland Ditch. *Photos (1) and (2) by Roy Anderson, (3) photos by Paul Emery, both of Greeley Daily Tribune Staff.*

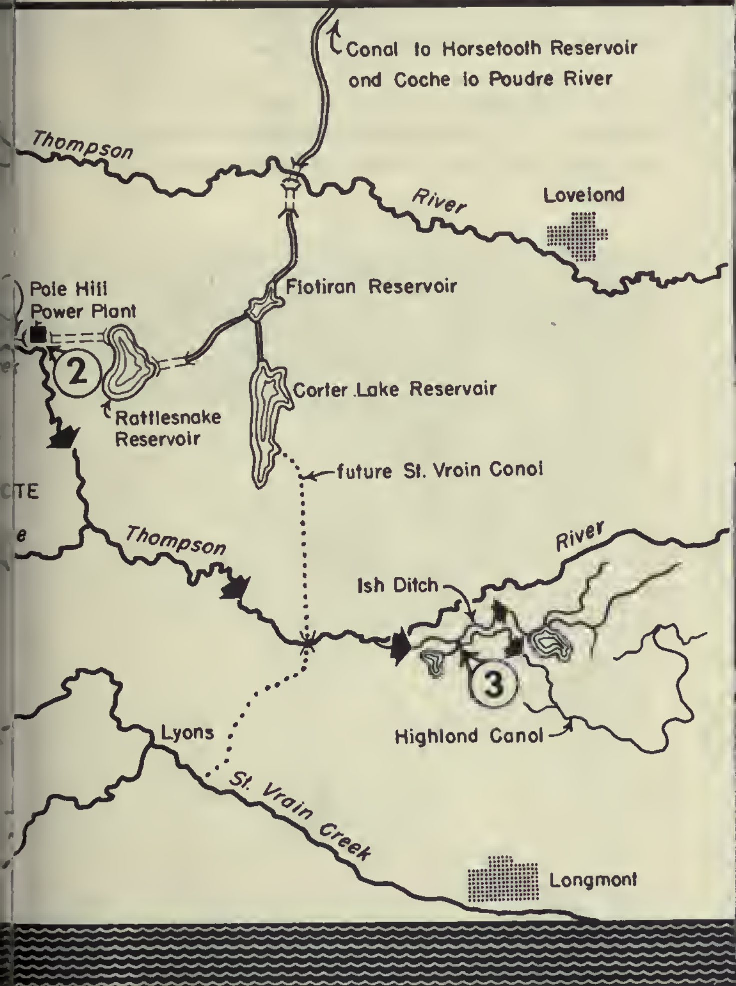


INGENUITY

(Continued from page 163)

gate my corn. So for all practical purposes, my ditch was to be dry after July 8. I had 30 acres of sugar beets and 17 acres of corn which had made a wonderful start and I hated to see them burn. But then I was informed that I could get plenty of water (thanks to the back door method) to irigate my sugar beets and corn at least twice after my Highland Ditch water was done. Without Colorado-Big Thompson water coming in through the back door, my crops would have really suffered. Thanks to the Conservancy District, my ditch company board, and the Bureau of Reclamation, I will again pay an income tax for 1953. I am especially thankful to Mr. Charles Meador, who has been superintendent of our Highland Ditch for 45 years and has given a lifetime of service to Highland Ditch water-users.

If for any reason we cannot get supplemental irrigation water directly down the St. Vrain next season, my back door is still open, so—bring it in the back door!



THE MEINERS, Kathy, 4, and Terry, 6. *Photo by Stan Rasmussen, Region 1.*

National Employ the Physically Handicapped Week has been designated as October 4–10 by President Dwight D. Eisenhower. This is the ninth year in which the "Week," which only points up the problem, will be observed. The program for employing the physically handicapped includes every week in the year. There can never be any relaxations in the continuing programs that are carried out in the national, state and community levels in the interest of those with THE WILL TO WIN.

In a message to members of the President's Committee on Employment of the Physically Handicapped, the President said recently: "* * * I share with thousands of other Americans a deep interest in the future of handicapped people in this country. * * * Our Nation can ill afford to lose the productive power and talents of those who are idle because they are disabled. We need them as active, productive citizens."

Last year the *Reclamation Era*, at the request of Vice Admiral Ross T. McIntyre IMCI, USN, Retired, Chairman of the President's Committee on Employment of the Physically Handicapped, cooperated by publishing the article, "Ready, Willing, and Able" in the October 1952 issue. Here is this year's story of people in the Reclamation area who have already proven the wisdom of Admiral McIntyre's statement when he said: "It must be recognized that rehabilitation must be made available to more and more people and that the end result of rehabilitation is employment."

WILL TO WIN

John M. Meiners, a GI-homesteader on the Roza Division of the Bureau of Reclamation's Yakima project in Washington State, walked through a lush field of green alfalfa, carrying part of a sprinkler system. A hay baler worked nearby. In the distance he could see his two small children playing on the front lawn of his home, and his wife picking vegetables in the garden. He paused for a moment, a satisfied expression on his face, as he took stock of his fortunes.

Small wonder the ex-infantryman should hesitate to count his blessings because only 6 years previous, when he was selected as the winner of this homestead, in 1947, the now lush fields were nothing but sagebrush and he was a 60-percent disabled veteran of World War II as a result of wounds from the push into the Po Valley of Italy.

John Meiners' success story is one of courage, perseverence, and vision. He was shot through the back and spent 7 months in the hospital at Baxter in Spokane. There he met an attractive girl, who, as a member of the Army Nurse Corps, helped nurse him back somewhere near to normal health. Two days after he was released, in 1945, they were married. "He got me by tripping me with his crutches," says Mrs. Meiners. "She doped me up so I couldn't defend myself," answers John.

Even though the aftereffects of the wound handicapped him—John has undergone 3 operations since he began farming, making 17 in all, and despite the 60-percent disability rating, he quickly removed the sagebrush, leveled the land, and brought the somewhat sandy soil into full production. In 1948 it was all in alfalfa.

He began building the house, at the same time sunk a well, planted shade trees, put in a lawn, built other buildings and raised a garden.

It wasn't always easy, but they never lost heart. "The wind blew something fierce," John reminisced. "Some of the alfalfa I had to plant two or three times, but we're glad we undertook it."

Today he has a comfortable home for his wife and two youngsters, Terry and Kathy, worth a

A "product" of the homestead farm is 4-year-old Kathy, who is "helping" her father move the sprinkler system, above left. Kathy was 3 months old when the Meiners moved on the land. CONTRAST—Top photo shows Meiner's undeveloped land in 1947; photo immediately above shows same spot in 1953. *All photos by Stan Rasmussen, Region 1.*

conservative $40,000, including land, equipment, etc., which he hopes to own outright pretty soon. Furthermore, they are earning a good living from the "place." And most important—they're a happy couple.

Year by year evidence accumulates and proves convincingly that it is good business to hire the handicapped. The performance of handicapped personnel on the Bureau of Reclamation's Denver offices payroll offers undeniable evidence to this effect.

Now working in the Bureau's Supply Field Division are two excellent cases in point. There are others, of course, but the two described prove the paradox that physically impaired employees are sound employees, and may perform more satisfactorily than their nonhandicapped coworkers.

Joseph W. Flinn.

Joseph W. Flinn, a file clerk in the Communications and Records Section in the Denver Staff Offices of the Commissioner, has been a Federal employee since December 1946. He started as a messenger with the Veterans' Administration in Denver, and transferred to Reclamation's messenger rolls exactly 2 years later.

Undaunted by Parkinson's disease, contracted during his Army Service from 1943 to 1946, Joe did an outstanding job as a messenger. Because he is alert and conscientious, Joe was promoted in 1951 to a file clerk's position.

A tremor in his left arm and leg forces Joe to be more careful, particularly when he handles a large handful of file material. This enforced extra care may account for his superior performance in other aspects of the job. Supervisors' ratings show that he has outstanding work habits and attitude, Allen C. Dunaway.

and indicate that he is more than adequate in such important qualities as skill in applying proper techniques and procedures, attention to pertinent detail, speed in completing assignments, cooperativeness, and dependability.

One of Joe's fellow employees, Allen C. Dunaway, lost his left leg at the hip while serving in the United States Army Air Force during World War II. Al is a microphotographer in the Communications and Records Section, and has been working for the Bureau continuously the last 7 years.

The fact that he has only one leg hinders him not at all in performing capably and satisfactorily with the photographic equipment he uses. Al processes Bureau records to be microfilmed, determining the best method and sequence in which material should be placed on the reels of film. He checks exposures to insure that there are no errors in recording. Also, Al maintains a card index of filmed records. He answers requests of other employees to see the material, and operates the projection equipment required.

Like Joe, Al has been more than satisfactory in his job. Ratings by his supervisors show that his skill, quality of work, dependability, and attention to detail are far above average.

Both Al and Joe are classed as "Disabled Veterans." However, it seems that such a label possibly is misleading. True, each made a great sacrifice for his country, and although Uncle Sam provides them some small advantage when applying for a job with him, they are paid only for full-time, productive work. Each earns his paycheck.

Kurt H. Pedersen, Engineering Aid, South Platte River District, Bureau of Reclamation, Denver, Colo., is another "Sound Business" example. Although badly handicapped by arthritis and the resulting crippling effects, he misses very few days from his drafting table where he turns out the drawings necessary to his department.

L. to R. Daniel K. Shepherd, Kurt H. Pedersen, and Denver B. Gimlin.

A veteran of World War I, Mr. Pedersen's present trouble seems to have started in 1931 when, working as a structural inspector, a scaffold collapsed and his back was fractured in the fall. During the ensuing years he has waged a determined fight against total disability, and now, although the fingers on both his hands are misshapen and stiff and he is forced to depend on crutches to get to and from his work, he produces good drawings, is very industrious, and at 58 years of age is studying engineering design—he refuses to stand still either physically or mentally. His fortitude in accepting this misfortune and his firm resolution to keep on working (which he says would have been impossible without the constant help and understanding of his wife), combined with health courses, vitamins, and constant exercise, have enabled him to continue to perform valuable and needed work.

Always cheerful, apparently never depressed, never complaining, but always looking on the bright side, Mr. Pedersen is an inspiration and example for all who may think they have misfortunes with which to cope.

Denver B. Gimlin, maintenance electrician at the Granby Pumping Plant of the Colorado-Big Thompson Project, follows the pattern. Mr. Gimlin's job involves work on equipment throughout the plant (equivalent to a 10-story building) and the many installations at dams, gates, high-voltage transmission switchyards, and other works in the Granby-Grand Lake area on the western slope. Heavy physical labor is not a requirement, but a great deal of active physical work is inherent in the job. Although Mr. Gimlin has his right leg amputated below the knee, he "gets around" in a completely adequate manner.

Daniel K. Shepherd, camp utility mechanic, Green Mountain Unit, Colorado-Big Thompson Project, makes the proverbial one-armed paper-hanger look like a loafer. Despite his loss of one hand, Shepherd has accomplished prodigious tasks. He does the work of carpenter (seeing him drive a nail with only one hand is quite an experience) cabinetmaker, painter, bricklayer, rock mason, form builder for concrete, plumber and gardener. His supervisor claims that most jobs turned out by Shepherd are far better than the average turned out by persons not similarly handicapped.

An outstanding piece of work he has completed, with help only about half the time, is the construction of the boathouse at Green Mountain Reservoir. There are numerous other structures at Green Mountain camp, such as a utility shop, garage extension, room added to a house, concrete sidewalks, which testify as to Shepherd's ability and versatility.

These are only a few examples of how the handicapped, with THE WILL TO WIN, have helped themselves.

Purchasing Power of Reclamation

The Bureau of Reclamation has been paying back the Government's investment at gilt-edge security rates. When people of the West are able to raise their own standard of living and guarantee their purchasing power through stabilized irrigation agriculture, it means prosperity for them. But more important it means prosperity to the manufacturers and merchants of the entire country. They buy more and more consumer goods as their incomes increase. Proof of this vast purchasing power can be found in reports on the incoming and outgoing railroad shipments to a typical reclamation area during recent years. This area is the Ada and Canyon region of Idaho where the Boise project is located.

Approximately one-third of the volume and two-thirds of the value of all railroad shipments of freight into these counties were from the 37 States east of the Rocky Mountains. For every carload shipped out of the area one and one-half carloads were shipped into the area. Thus we see how the rest of the Nation benefits from newly created or expanded reclamation developments. #

New Map of Irrigated Lands

The Bureau of the Census has just completed a new map showing irrigated lands in the 17 Western States, Arkansas, and Florida. It is 34 x 41½ inches and may be purchased from the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C., for 35 cents.

"GET ACQUAINTED" COPIES

If you have friends or associates who would be interested in the Reclamation Era, please send their names and addresses to the Bureau of Reclamation, Washington 25, D. C. We shall be glad to send them copies of back issues.

RECLAMATION'S HALL OF FAME

Nomination No. 18

JOHN S. MOORE

On May 2, 1953, John S. Moore was laid to rest in Terrace Heights Memorial Park at Yakima, Wash. Death came to Mr. Moore at the age of 66, after having served 45 years as an engineer and administrator in the field of reclamation. Those who had known John Moore intimately, realized how fitting a tribute was spoken when at the funeral service he was described as "a great man of firm, yet kind and stalwart integrity."

Reclamation of the arid lands of the West was his life work, but into life were woven the finer characteristics of a true Christian gentleman, with a firm, but soft-spoken voice and a kindly disposition, which made him an understanding father, a successful engineer, an outstanding administrator and a sincere friend to all who came in contact with him.

He was born in Charleston, W. Va., October 4, 1886, and received a degree in Civil Engineering from Washington and Lee University in 1907. A year later the young engineer traveled West to take a position as Junior Engineer on the Minidoka Project in southern Idaho. The U. S. Reclamation Service was then only 6 years old.

In August 1908, young Moore was transferred to the Yakima Project, where he was assigned to the irrigation operations staff at Sunnyside, Wash. The project was then in its third year of Government operation, having been taken over from the Washington Irrigation Company in 1905. Managers and Superintendents of irrigation projects were, in those days, truly "grass roots" men who had to learn the hard way. John Moore was one of the pioneers who faced the challenge of those eventful years, and gave himself to a lifetime service as an Operation and Maintenance engineer and administrator, a service which few others have accomplished.

The old friends in Sunnyside knew John as "Bunny." How the nickname originated we are not certain, but it could have been that it was attached to him by Juanita Noble, the daughter of a pioneer Sunnyside farmer, who intently watched him chasing the jack rabbits from his path as he surveyed the flow-line contour along which the irrigation ditches were being constructed on her father's farm. Anyway, the nickname stuck as well as did the marriage in 1910 of Juanita (Nita)

Noble and John S. (Bunny) Moore. The Moore family has 6 children and 12 grandchildren. "Nita" needs no introduction to the Reclamation family because she is known to most of them as John's charming partner, who enjoyed life to the fullest and fitted into the picture upon all occasions.

In 1917 Moore was transferred to the Tieton Division of the Yakima Project to take over the responsibilities of Superintendent of Irrigation. Significant to the esteem with which the young Maintenance Engineer was regarded, is the statement of the Sunnyside Manager, who called the office group into conference and advised them that, since Mr. Moore was being transferred, it would be necessary for all of the remaining employees to take on considerably greater responsibilities, because they would no longer have the guidance of their former supervisor. He stated that few men possessed the keen judgment and administrative skill of Mr. Moore. They would miss him but were happy over his well deserved advancement.

His administrative abilities brought further advancement to the position of Superintendent of the entire Yakima Project in 1931, and ten years later he was transferred to Denver as Supervisor of Operations and Maintenance for the Bureau. The rigors of carrying on that responsibility during the second World War impaired his health so that he found it necessary to take on less arduous duties. In 1945 he moved to Boise where he served as Assistant to Regional Director Bob Newell. In that capacity John was Bob's intimate counselor in directing the expanding activities in Region 1, during and immediately following World War II.

After he recuperated, Mr. Newell asked Moore to take over the Superintendency of the Minidoka Project. There were some difficult administrative problems to handle on that project, so John Moore accepted the challenge. He served as Project Superintendent for about 2 years and retired in 1950, returning to Yakima to be near his family and lifelong friends.

Retirement from Government service simply meant greater freedom of action for Moore, but he took on other jobs. He became secretary of the Yakima Masonic Lodge, and was elected to the presidency of the Washington State Reclamation Association. The State Supervisor of Hydraulics also called upon him to serve as watermaster for the administration of water rights in the Yakima Valley. This latter job he thoroughly enjoyed as it kept him in touch with the irrigation farmers. He often spoke of it as his "Glorified Ditchrider" job.

Mrs. Moore speaks with great enthusiasm about a 53-day trip, made after their retirement, in which they circled the United States and visited 51 retired Reclamation employees. I am sure that those visited will recall the Moores with equal enthusiasm. ###

Full And Supplemental Irrigation Service Land

The latest definitions for Full and Supplemental Irrigation Land have been incorporated in the Bureau of Reclamation's Manual.

For your information these definitions are:

*Full Irrigation Service Land** is irrigable land now receiving, or to receive, its sole and generally adequate irrigation supply through works or facilities constructed by or to be constructed by the Bureau of Reclamation. This term applies also to previously irrigated land in non-Federal projects where a substantial portion of the facilities has been, or is to be, constructed, rehabilitated or replaced by the Bureau.

*Supplemental Irrigation Service Lands** is irrigable land now receiving, or to receive, an additional or re-regulated supply of irrigation water through works or facilities constructed by or to be constructed by the Bureau of Reclamation. Such supply together with the supply from nonproject sources will generally constitute an adequate supply. #

* These definitions apply to any Bureau of Reclamation project, including those in the planning, development, and operation stages.

YOUR MAGAZINE

Are there particular types of articles which you would like to see in the ERA that we have not printed to date? If so, please let us know, and we shall do our best to comply with your wishes.

LOW COST IRRIGATION STRUCTURES

Third and last of a series of three articles based on information contained in Circular 122, a publication of the University of Wyoming, Extension Service

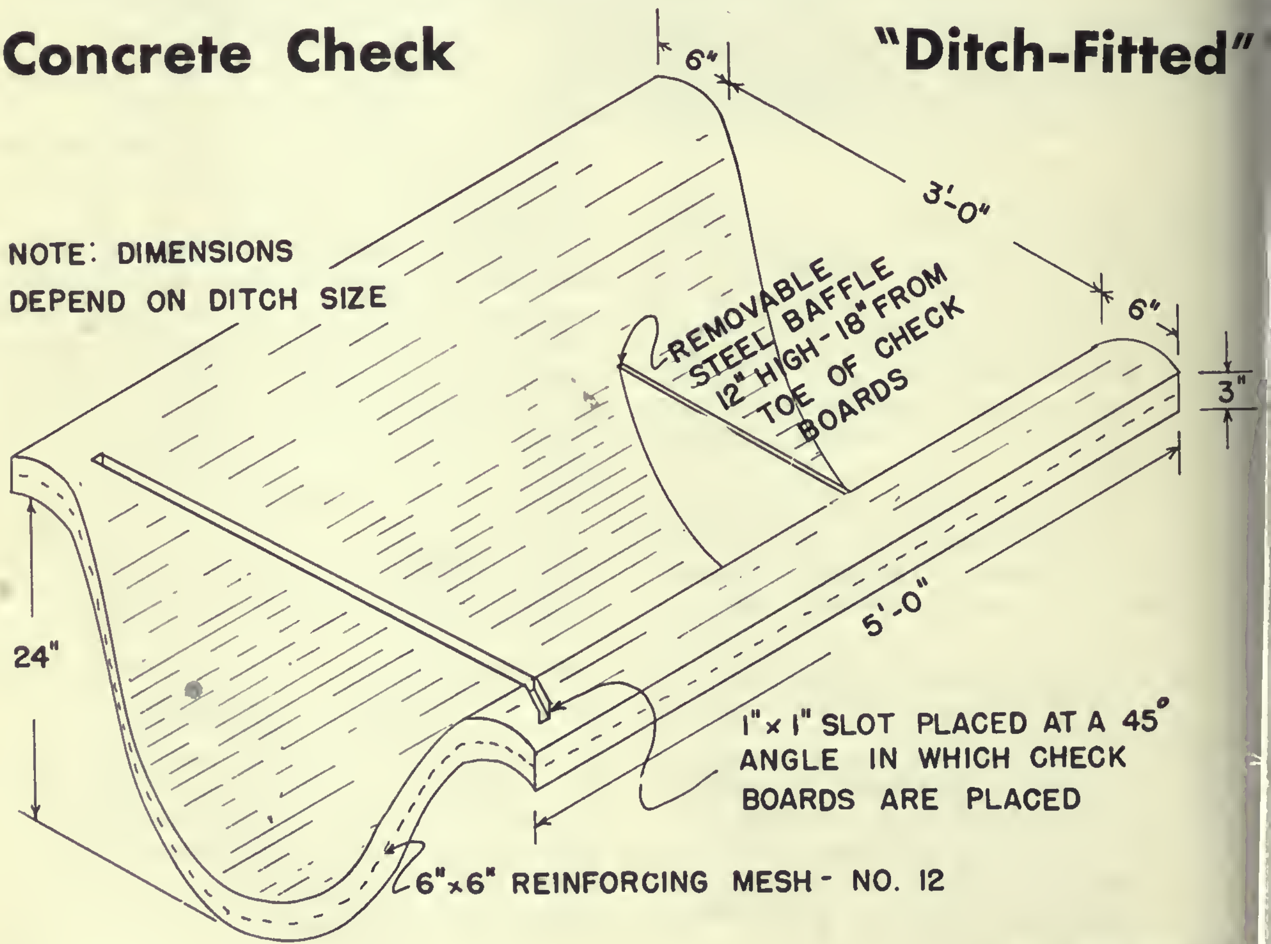
Permanent checks in your irrigation system can bring about vast savings in labor and can improve irrigating efficiency. Thanks to the efforts of irrigation engineers, permanent ditch-fitted checks have been developed which are durable and still permit use of ditch-cleaning equipment.

These checks, made of either concrete alone, concrete with concrete blocks, or wood, can maintain a constant water level in your ditch, permitting proper siphon irrigation—a feat often impossible with dirt dams.

One of the simplest is a concrete check formed to the contour of the ditch. By using a stiff mix, the concrete can be poured without using forms. A slot is then placed down both sides of the fresh concrete for check boards to slide into.

Another ditch-fitted check can be made of concrete blocks. Pour an 8-inch wide foundation across the bottom of the ditch and then at each end of this slab pour additional concrete to continue the foundation under each bank, these side sections to be placed at a 90° angle to the slope of the bank. Lay regular-sized concrete blocks up the side from the foundation, so that the face of the blocks will be flush with the face of the ditch bank from bottom to top. The blocks should have a 2- by 2-inch groove on their face to accommodate the check board, which is beveled on the ends to fit the slope of the grooved blocks. This check can be made simply and quickly with six concrete blocks and a few cubic feet of concrete. Besides being inexpensive and easy to install, this check allows ditch-cleaning equipment to pass through simply by lifting the nose of the ditcher.

Concrete Check "Ditch-Fitted"



To build another good permanent concrete-block heck, pour a concrete foundation 8 inches wide nd 4 inches thick across the bottom of the ditch nd set the first blocks while the concrete is still resh. The other blocks are set on top of the first locks and the cored holes in the block filled with oncrete, binding them firmly together. A spillway of concrete or rubble masonry can be placed t the toe to reduce the danger of soil erosion from he force of the stream. Grooved blocks provide check-board slot in the opening. This structure s ideal as a combination check and drop. When sed as a check alone, the spillway is sometimes eft off the structure.

Another ditch-fitted check, which permits ready se of ditch-cleaning machinery, consists essenially of a pour of concrete, approximately 3 inches hick, covering the bottom and slopes of the ditch for a 5-foot length. The concrete is reinforced with 6- by 6-inch 12-gauge reinforcing mesh.

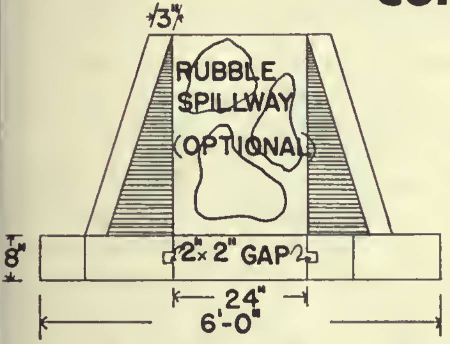
A 1- by 1-inch slot for the check board is placed in the fresh concrete, slanting down to the bottom of the ditch from the top at a 45° angle. If steel check boards are used, it is much easier to form the check slot and the danger of the check board floating is reduced. A vertical slot for a removable steel baffle is placed 18 inches down from the toe of the check board. The baffle, about 12 inches high, serves to break up the rapid flow of water.

A number of alternative structures—involving modifications of the above checks, made either of concrete, concrete blocks, or wood—can be improvised to meet specific farm needs and conditions.

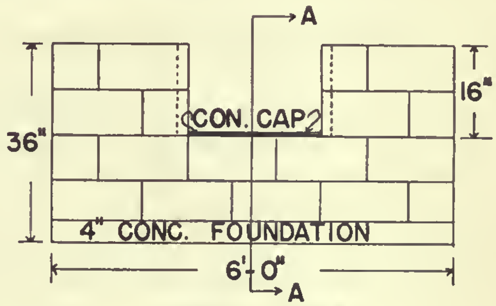
The Agricultural Extension Service of the University of Wyoming has recommended that, for best results, the following guides should generally be followed in the construction:

1. All concrete mixes should be 1–2¾–4 (ratio volumes of cement to sand to gravel), with a water-cement ratio of 5½ gallons per sack of cement.
2. Mortar mixes are 1–2½ masonry cement (ratio of volumes of cement and sand), or 1–1–5 for cement, hydrated lime, and sand mix.
3. All lumber should be preservative-treated.

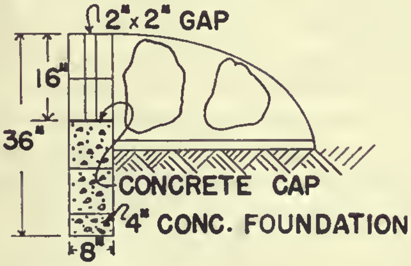
Concrete Block Check



TOP VIEW



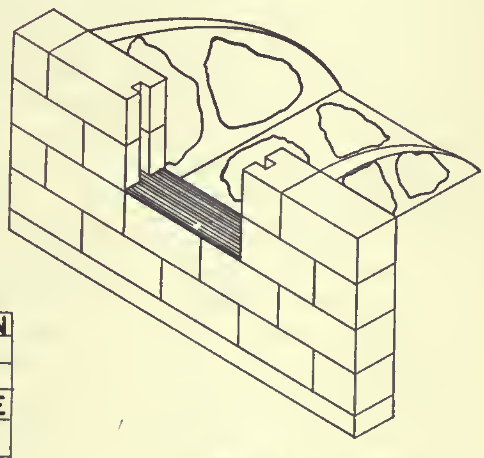
FRONT VIEW



SECTION A-A

BILL OF MATERIALS

NO.	SIZE	DESCRIPTION
10	8"x8"x16"	REGULAR
4	8"x8"x8"	"
2	8"x8"x16"	2"x2" GROOVE
2	8"x8"x8"	" "
3 CU. FT. CONCRETE		


ISOMETRIC VIEW

NEBRASKA LEGISLATORS HONORED—In appreciation for the splendid services rendered by Senator Hugh Butler (left photo) as Chairman of the Committee on Interior and Insular Affairs, U. S. Senate, and Hon. Dr. A. L. Miller (right photo) as Chairman of the Committee on Interior and Insular Affairs of the U. S. House of Representatives, recently the Nebraska Reclamation Association presented beautiful gavels and stands, with appropriate plaques, to both.

The bases were made of box elder, the stands of red cedar, and the gavels of hickory—all from native Nebraska trees cut from the University of Nebraska campus in 1893. The wood was contributed by Dr. George E. Condra, veteran director of the Conservation and Survey Division of the University of Nebraska. Through the courtesy of President Herbert L. Cushing of the Nebraska State Teachers College at Kearney, the gavels and stands were made by the Vocational Arts Division of that institution.

C. Petrus Peterson, President of the National Reclamation Association, made the presentation to Senator Butler at a committee meeting in the U. S. Senate committee room. William E. Welsh, Secretary-Manager of the National Reclamation Association, made the presentation to Dr. Miller during a hearing in the committee room, U. S. House of Representatives. Left photo by World Wide Photos, right by Glenn Peart, Interior Department.

Commissioner Dexheimer

Continued from page 153

the proposed billion dollar Snowy Mountains Hydroelectric Development and the Kiewa Hydroelectric Development in Australia. He has since made two trips as chairman of a board of engineers for further planning of the Snowy Mountains Project. He also served as the Bureau representative on construction of Falcon Dam, being built by the International Boundary and Water Commission under treaty with the Republic of Mexico. Early in 1953 he acted as chairman of a board of engineers to make a study of hydroelectric developments in Formosa for the Mutual Security Administration. He is a member of the American Society of Civil Engineers.

He is married to the former Johnnie Hadnot of Wellton, Ariz., and has one young son.

The appointment of Mr. Dexheimer as Commissioner was exceedingly well received throughout the Bureau and in the Western States where Reclamation operates. He is the second career employee of the Bureau to be promoted to a high post in the organization recently. The other was Clyde A. Spencer, Construction Engineer at Hungry Horse Dam, Mont., who was made Supervising Engineer of the California Projects with headquarters at Sacramento.

ADDITIONAL CHANGES IN RECLAMATION PERSONNEL

As this issue went to press, Commissioner Dexheimer announced the following changes in Reclamation personnel: The number of Assistant Commissioner positions was reduced from three to two. Assistant Commissioner Harvey F. McPhail will continue to serve as Assistant Commissioner. Assistant Commissioner Kenneth Markwell's position was abolished. Goodrich W. Lineweaver will become Assistant to Commissioner Dexheimer, advising on financial and legislative matters.

Floyd E. Dominy was appointed Director of Operation and Maintenance. E. D. Eaton will serve as Assistant Director of Operation and Maintenance. N. B. Bennett was named Director of Project Planning succeeding J. W. Dixon.

The Division of Management Planning was abolished, and some of the functions and personnel of that office will be transferred to the Division of Personnel temporarily. All changes are effective October 1.

LETTERS

"Investigate Before You Invest" Is Good Solid Information

RICHMOND, CALIF.,
May 12, 1953.

BUREAU OF RECLAMATION,
U. S. Department of Interior,
Washington 25, D. C.
Attn. Mr. J. J. McCarthy, Acting Editor
THE RECLAMATION ERA

DEAR MR. MCCARTHY: With high interest we have read subject article written by Claude H. Pair and L. R. Swarner.

We would appreciate very much hearing from you soon as to the availability of reprints of subject article, cost of same in quantities of 1,000, 2,000 or 3,000 if available, or if reprints are not available would you and the authors allow us to reprint same. If the latter please advise regulations which might apply.

We believe that this is the kind of information which should be placed into the hands of prospective purchasers all over the country and submit a copy of our small pamphlet "Plan Agricultural Sprinkler Irrigation" which we wrote and issued in 1948. We have issued several thousand of same in California since.

We hope and trust that somehow you will allow us to get this good solid information into the hands of several thousand more people with the authoritative ring of the names of the men who wrote this article.

Sincerely,
ALSCO, INC.
L. T. Slauson, Pres.

Our Appreciation to The American Society of Agronomy

MADISON, WIS.
July 24, 1953.

DEAR SIR: Thank you for your courtesy in sending us the information copies of the July 1953 issue of *Reclamation Era*, with the Diebold article. May I congratulate you on an all-around good looking issue. You really caught some of the beauty of the West in the Scottsbluff picture.

Sincerely yours,
[S] MAURICE R. HAAG,
Crops & Soils, The American Society of Agronomy.

Food Machinery & Chemical Corporation Finds It Helpful

SAN JOSE, CALIF.,
August 3, 1953.

GENTLEMEN: Our sprinkler irrigation department (Shur-Rane Systems) would like to order 6 copies of your June 1953 issue (*The Reclamation Era.*)

We think it is a wonderful magazine—our Shur-Rane department finds it especially interesting.

Yours very truly,
FOOD MACHINERY & CHEMICAL CORPORATION, *John Bean Division.*
[S] CONNIE DUCKWORTH,
Advertising Dept.

Reprints Requested

VISTA, CALIF.,
June 18, 1953.

DEAR SIR: Enclosed is a subscription to *The Reclamation Era.*

Please advise the availability of a reprint of the article by Mr. Corey in the June issue on page 116. We would like to obtain 500 copies of this or the permission to reprint for free distribution.

Yours very truly,
ROBERT H. WEHREN,
Business Manager,
Portable Aluminum Irrigation Co.,
Vista, Calif.

The article referred to was "Light, Frequent Irrigation Best" which describes the most economical and effective method of irrigation. Reprint permission was gladly granted.—Ed.

CROPS

1952 Record Year

For the first time in Reclamation history the gross crop value of a single Reclamation harvest neared the 1-billion-dollar mark during 1952.

The $935,679,755 crop constituted an increase of $113,958,090 over the previous year's $821,721,665 harvest, and marked the seventh consecutive year of crops grown on Reclamation projects at values in excess of a half-billion dollars. It is important to note that this increase occurred in a year when there was no material change in the overall index of crop prices from the previous year. The cumulative value of all Reclamation harvests through 1952 is more than $8.9 billion as compared with a total Federal investment in all Reclamation works of less than $2.2 billion as of June 30, 1952.

The harvest of 1952 was made up of 23,606,400 tons of food, forage, and fiber and was over 1½ million tons greater than the 1951 harvest. Of the total, 52.9 percent (12,484,619 tons) was in hay, pasture, forage, and cereal groups, 26.5 percent (6,268,744 tons) was in field crops and seeds, and 20.6 percent (4,853,054 tons) was in vegetables, truck, fruit, and nut groups. In terms of acres, the most significant crop group was hay and forage with 44 percent of all irrigated lands producing these crops. The 10,837,700-ton harvest of these crops contributed materially to the orderly use of the 700-million-acre western range.

The 1951 crop contained 4,674,267 tons of fruits, nuts, vegetables, and pulses. Production of these so-called protective foods increased in 1952 to 5,075,933 tons. (Figures for both years include dry beans which for other purposes are grouped under field and seed crops.) Thus, production in 1952 in this critical group increased by slightly over 400,000 tons.

The most significant individual crop produced in 1952 was cotton, which made up approximately 25 percent of total crop value and utilized about 11 percent of the irrigated land. Highest per acre values were reported on the Coachella Division of the Boulder Canyon Project and the Central Valley Project, both in California, where nearly 1,400 acres of fresh market tomatoes produced values in excess of $2,600 per acre.

The importance of crop specialties to the Reclamation farmer in 1952 is evidenced in the production of nearly 200,000 acres of crops with gross values of $500 per acre and over. In aggregate the value of these crop specialties was over $143.1 million, or $718 per acre.

Wide variation was again reported in 1952 in water requirements and deliveries with sharp differences reported between projects and in some instances between districts on the same project.

MAJOR CONTRACTS AWARDED DURING JUNE AND JULY 1953

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DC-3915	Central Valley, Calif.	June 4	Construction of earthwork and structures for laterals, sublaterals, and wasteways for north section of unit 1, Madera distribution system.	H. Earl Parker, Inc., Marysville, Calif.	$656,393
DS-3916	Yakima, Wash	June 22	One 11,200/14,000-kilovolt-ampere transformer with lightning arresters, current transformers for Chandler switchyard.	Central Transformer Corp., Pine Bluff, Ark.	56,920
DC-3923	Columbia Basin, Wash	June 12	Construction of earthwork, pipelines, and structures for area W-7 (block 78) laterals, sublaterals, and wasteways, West canal laterals.	Cherf Brothers Construction Co. and Roy F. Johnson and Sandkay Contractors, Inc., Ephrata, Wash.	391,170
DC-3926	Gila, Ariz	June 4	Construction of Water Users' administration building	Arrow Construction Co., Inc., Yuma, Ariz.	91,591
DC-3934	Rio Grande, N. Mex	do	Construction of earthwork and structures for wasteway channels for Picacho Arroyo control.	Evans and Shaffer, Mesilla Park, N. Mex.	39,827
DC-3935	Middle Rio Grande, N. Mex	do	Construction of channel erosion control and surfacing access roads in Elephant Butte area.	Floyd Haake, Santa Fe, N. Mex	56,764
DC-3937	Palisades, Idaho	June 11	Construction of Snake River bridge superstructure for relocation of Wyoming state highway, U. S. 89, near Palisades reservoir.	LeBoeuf-Dougherty Contracting Co. and Erickson & Pierson, Richmond, Calif.	296,270
DC-3938	do	do	Construction of Snake River bridge substructure and roadway approach embankment for relocation of Wyoming state highway, U. S. 89, near Palisades Reservoir.	J. A. Jones Construction Co. and Charles H. Tompkins Co., Seattle, Wash.	176,580
DS-3941	Central Valley, Calif	June 23	4 vertical traveling water screens for unit 1, Delano-Earlimart irrigation district, Friant-Kern canal distribution system.	Link-Belt Co., San Francisco, Calif	42,184
DC-3957	Boulder Canyon, Ariz.-Nev	do	Anchoring rock slab on canyon wall above Nevada valve house, Hoover Dam and powerplant.	Selby Drilling Corp., Los Angeles, Calif.	111,909
DS-3943	do	do	3 vertical-shaft, mixed-flow or propeller-type pumping units and thirteen vertical-shaft, turbine-type pumping units for lateral pumping plants, Plain View water district, Delta-Mendota canal distribution system.	Fairbanks, Morse & Co., Kansas City, Mo.	34,043
DC-3953	Colorado-Big Thompson, Colo.	do	Construction of earthwork and structures for Boulder Creek supply canal with timber bridge decks, schedule 2.	Bales and Kite, Kansas City, Mo	972,077
DC-3954	Gila, Ariz	do	Construction of earthwork, concrete lining, and structures for Dome canal and Unit 1 of Dome distribution system.	Morrison-Knudsen Co., Inc., Los Angeles, Calif.	1,990,792
DC-3967	Missouri River Basin, Nebr	do	Construction of Enders dam auxiliary drainage	Claussen-Olson-Benner, Inc., Holdrege, Nebr.	27,580
DC-3977	Missouri River Basin, S. Dak	June 25	Drilling irrigation wells Nos. 1 and 2 near Tulare and Burdette, S. Dak.	Sterling Norbeck, Redfield, S. Dak.	12,776
DC-3940	Missouri River Basin, Nebr	July 16	Construction of earthwork and structures for laterals, sublaterals and drains for Cambridge Canal, station 1574-29 to station 2607-93.	Bushman Construction Co., St. Joseph, Mo.	1,224,616
DC-3942	do	do	Construction of earthwork and structures for Naponee Canal, station 0-00 to station 473-25 and lateral 2.1 and Franklin laterals 5.4 to 24, inclusive.	do	542,616
DS-3944	Gila, Ariz	do	Five motor-control switchgear cubicles for Wellton-Mohawk Pumping Plants No. 1, 2, and 3.	Westinghouse Electric Corp., Denver, Colo.	58,866
DC-3947	Columbia Basin, Wash	July 13	Earthwork, pipe lines and structures, area W-6B (Block 76) laterals, West Canal laterals.	Cherf Brothers Construction Co., Roy F. Johnson and Sand Kay Contractors, Inc., Ephrata, Wash.	512,541
DC-3950	Yakima, Wash	July 7	Construction of Chandler power and pumping plant and appurtenant works.	A. J. Cheff Construction Co., Seattle, Wash.	1,957,713
DS-3951	Fort Peck, N. Dak	July 6	Outdoor power transformer for Williston substation	Westinghouse Electric Corp., Denver, Colo.	233,979
DS-3955	Gila, Ariz	July 23	Pumping units 6 pumping plants, unit 1, Dome Distribution System.	Fairbanks, Morse & Co., Kansas City, Mo.	42,970
DS-3963	Palisades, Idaho	July 21	Two 19.67-foot by 28.03-foot fixed wheel fates for outlet and power tunnels at Palisades Dam and powerplant.	American Bridge Division, U. S. Steel Corp., Denver, Colo.	185,300
DC-3966	Rio Grande, N. Mex.-Tex	July 15	Furnishing materials and installing overhead ground wires on existing 115-kilovolt transmission lines.	Hoak Construction Co., Des Moines, Iowa.	422,385
DC-3972	Columbia Basin, Wash	July 10	Construction of earthwork, pipelines and structures, area P-9 laterals, PE-55 to PE-66, inclusive, sublaterals and wasteways, Potholes East Canal Laterals.	Osberg Construction Co., Seattle, Wash.	1,383,097
100C-167	Minidoka, North Side Pumping Division, Idaho.	July 21	Drilling 21 water supply wells	R. J. Strasser Drilling Co., Portland, Oreg.	91,886
110C-169	Snake River, Mountain Home Division, Idaho.	June 26	Drilling, casing and testing observation and test wells	Hardin & Co., Boise, Idaho	20,599
300C-58	Gila, Ariz	July 29	Land leveling and construction of farm laterals, and structures for Mesa Development Farm.	Rankin & Booth Constructors, Inc., Yuma, Ariz.	58,52
400C-41	Provo River, Utah	June 26	Earth lining, Weber-Provo Diversion Canal, station 180+00 to station 205+51.	Davis & Butler Construction Co., Salt Lake City, Utah.	28,305
601C-34	Shoshone, Wyo	June 25	Construction of open and closed drains	D. M. Manning, Hysham, Mont	52,935
605C-21	Buffalo Rapids, Mont	June 17	Earthwork and structures for open and closed drains	E. G. Perry & Son and Union Credit Co., Townsend, Mont.	142,025
617C-35	Riverton, Wyo	June 25	Construction of open and closed drains in North Pavillion and North Portal areas.	Sharrock & Pursel, Cooper, Wyo	44,791
700C-309	North Platte, Nebr	do	Construction of Brown's Canyon Dam	Ellis Construction Co., Golden, Colo.	25,073
704C-302	Colorado-Big Thompson, Colo.	June 24	Renovation and modification of 69-kilovolt and 115-kilovolt transmission lines.	Malcolm W. Larson Construction Co., Denver, Colo.	48,184

U. S. GOVERNMENT PRINTING OFFICE : O—1953

Construction and Materials for which Bids Will Be Requested by November 1953*

Project	Description of work or material
Central Valley, Calif.	Construction of Camino conduit involves 5.5 miles of 48- and 36-inch reinforced concrete pipeline, cylinder and noncylinder, or alternative steel pipeline, and construction of 2,400 feet of 6-foot horseshoe-type concrete-lined tunnel, located near Placerville, Calif.
Do	Construction of north section of Madera distribution system's Unit 3, Part 2, requires 21 miles of laterals and sublaterals varying from 85 to 15 cubic feet per second capacity, including checks, drops, road crossings, turnouts, division boxes, irrigation pipe crossings, and siphons, located 8 miles northwest of Madera, Calif.
Do	Constructing five rock-fill and sheet-pile drops in Dry Creek and 7.5 miles of open lateral, including siphons, turnouts, and concrete control structures, for the rehabilitation of Dry Creek and lateral 24.2, 10 miles northwest of Madera, Calif.
Do	Construction of the distribution system for unit 3 of the Delano-Earlimart irrigation district, covering a gross area of about 16,800 acres, will include 52 miles of reinforced concrete pipeline of from 60 to 12 inches in diameter, high-head pumping plants, low-head recirculating pumping plants, equalizing reservoirs, valves, slide gates, metal surge stands, and miscellaneous metalwork and electrical controls, near Delano, Calif.
Columbia Basin, Wash.	Installation of 230/295-kilovolt autotransformer and associated electrical equipment in Grand Coulee switchyard.
Do	Construction of 10 miles of drains in lateral area W-3 (block 71), will consist of excavating unlined ditch varying from 15 to 5 cubic feet per second capacities with base width of 3 to 2 feet, and constructing concrete structures, including drain inlets and road crossings.
Do	Construction of area P-4 (block 13) laterals, sublaterals, and wasteways, varying from 288 to 3 cubic feet per second capacities. Work consists of excavating 45.3 miles of unlined laterals and wasteways with base widths of 2 to 16 feet, 14.5 miles of pipeline from 12- to 60-inch culvert and pressure pipe, concrete structures, including division boxes, checks, culverts, seven small pumping plants, and three bridges.
Do	Construction of 23 miles of unlined reach of 560 to 160 cubic feet per second capacity with 10- to 24-foot bottom width for West canal's fifth section, will include constructing three county road bridges, 22 check structures, and 77 turnout structures, and furnishing and installing manually and motor-operated radial gates and hoists.
Davis Dam, Ariz.	Furnish materials and construct 35 miles of 115-kilovolt wood-pole H-frame transmission lines, including overhead ground wire, from Saguaro steam plant to Oracle, and from Saguaro to ED-5 substation.
Do	Erecting steel structures, installing electrical equipment, and constructing concrete footings for Knob substation, 8 miles west of Yuma, Ariz.
Milk River, Mont.	Excavation, placing concrete, grouting and general repair to Fresno dam spillway apron, near Havre, Mont.
Missouri River Basin, Kans.	Completion of Webster Dam on the South Fork of the Solomon River about 1 mile downstream from Webster, Rooks County, Kans., will include the following work: (*a*) Completion of earth-fill dam 110 feet high and about 11,000 feet long at 30-foot wide crest. Upstream slope will have riprap protection. (Foundation of portions of dam is under construction.) (*b*) Construction of earth-fill dike on left abutment, 10 feet high and about 2,500 feet long at 30-foot wide crest.
Missouri River Basin, Kans.—Continued	(*c*) Construction of concrete outlet works consisting of an intake structure, a 220-foot long, 4.5 foot diameter conduit, a gate chamber, a 270-foot long, 8-foot horseshoe conduit with steel pipe, a control structure, stilling basin, and a riprap-protected outlet channel. (*d*) Construction of concrete spillway consisting of a crest structure 116 feet wide controlled by three radial gates 33.33 feet by 39.51 feet, a 658 foot long chute, stilling basin 264 feet wide by 130 feet long, and a riprap-protected outlet channel.
Missouri River Basin, Mont.	Construction of operation and maintenance camp near Toston, Mont., will include constructing basement for a house, moving and placing the house on its foundation, and installing necessary utilities; and construction of a 24- by 40-foot prefabricated metal or concrete block shop-garage.
Missouri River Basin, N. Dak.	Raising 0.5 mile of road and constructing a bridge over James River 10 miles north of Jamestown, N. Dak.; and raising 0.5 mile of road and raising the present steel-truss bridge over the James River 23 miles north of Jamestown. Quantities include 175,000 cubic yards of excavation, 112 thousand feet board measure of lumber, 2,500 linear feet of wood piling, 200 linear feet of steel piling, and 9,000 pounds of other metal work. Roads are to be surfaced with gravel.
Missouri River Basin, Wyo.	Construction of 12.5-kilovolt bay and installation of a zigzag connected 3-phase grounding transformer. Contractor will furnish steel for structures and Government will furnish grounding transformer, circuit breakers, disconnecting switches, and instrument transformers, near Lovell, Wyo.
Missouri River Basin, S. Dak.	Construction of temporary Oahe substation will include erecting Government-furnished structural steel for bus structures; installing three 230-kilovolt and one 115-kilovolt Government-furnished power circuit breakers; installing a 100,000-kilovolt-ampere, 230-kilovolt autotransformer bank as well as 230-kilovolt and 115-kilovolt air switches and miscellaneous related equipment such as relays and lightning arresters, all Government-furnished; constructing foundations; and furnishing and installing lighting and control circuits. In addition, about 1½ miles of temporary 230-kilovolt wood-pole transmission line will be required, all materials for which will be furnished by the contractor.
Palisades, Idaho-Wyo.	Construction of gaging stations near Alpine, Wyo.
Rio Grande, N. Mex.	Construction of Picacho South Dam, 5 miles northwest of Las Cruces, N. Mex. will consist of a compacted earthfill embankment that, including the riprapped emergency spillway at the right end, will be approximately 1,680 feet long, 15 feet wide at embankment crest, and 28 feet high at embankment maximum section. It will require about 90,000 cubic yards of fill materials taken from reservoir borrow areas. An uncontrolled outlet works will pass under the left end of the embankment, and will consist of small concrete intake and outlet structures, and 120 feet of 36-inch diameter concrete pipe.
Vermejo, N. Mex.	Rehabilitation of 67.5 miles of 10 to 150 cubic feet per second laterals 8 miles northwest of Maxwell, N. Mex., in the Vermejo Conservancy district. Work includes excavation for 15.5 miles of new, relocated, or enlarged laterals; removal of about 71 concrete, 35 wooden, and 7 corrugated metal pipe structures; construction of about 192 concrete and 7 timber structures that include drops, checks, turnouts, bridges, and road crossings; and placing riprap at 28 existing structures.
Yakima, Wash.	The 6.6 miles of 500 cubic feet per second capacity Chandler Main canal, division 1, and 0.6 mile, 435 cubic feet per second Kiowa wasteway to be constructed near Prosser, Wash., will be concrete-lined for 1 mile and unlined for the remainder.

*Subject to change.

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